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The Teaching of Natural Sciences in the Early Years of Elementary School to Educate a Scientifically Literate Individual

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ABSTRACT

Background: One of the challenges in pedagogical practice in science in the initial years of elementary school (EF) is focused on developing objects of knowledge with an emphasis on scientific literacy. **Objective:** To investigate how the pedagogical practices of teachers of the 1st and 2nd grades of the elementary school contribute to promoting access and the development of scientific knowledge to educate a scientifically literate individual**. Design:** Ethnographic case study, through triangulation of data in a qualitative research perspective. **Setting and Participants:** Seven basic education women teachers who work in three different schools in the municipality of Vera Cruz/RS participated. **Data collection:** Observation and description in a logbook, questionnaires and interviews with teachers, as well as one student's notebook and the official school document (Pedagogical Political Project). **Results:** The promotion of subsidies for access and mediation of scientific knowledge in teaching actions, although a significant portion of teachers has little corroborated the education of a scientifically literate individual. **Conclusions:** There must be actions aimed at continuing teacher education to favour significant school environment changes.

Keywords: Natural Sciences teaching; Early years of elementary school; Scientific literacy; Scientific knowledge.

O ensino de Ciências da Natureza nos Anos Iniciais do Ensino Fundamental com Vistas à Formação de um Indivíduo Cientificamente Alfabetizado

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RESUMO

Contexto: Um dos desafios na prática pedagógica em Ciências nos anos iniciais do Ensino Fundamental (EF) está voltado ao desenvolvimento dos objetos de conhecimento com ênfase na alfabetização científica. **Objetivo:** Investigar como as práticas pedagógicas de professoras de turmas de 1º e 2º anos do EF contribuem para a promoção do acesso e o desenvolvimento do conhecimento científico à luz da formação de um indivíduo cientificamente alfabetizado**. Design:** Estudo de caso de cunho etnográfico, mediante a triangulação dos dados em uma perspectiva qualitativa de investigação. **Ambiente e Participantes:** Participaram sete professoras da Educação Básica que atuam em três escolas distintas do município de Vera Cruz/RS. **Coleta de dados:** Observação e descrição em diário de bordo, questionários e entrevistas com as docentes, bem como o caderno de um aluno e o documento oficial da escola (Projeto Político Pedagógico). **Resultados:** Há promoção de subsídios para o acesso e a mediação do conhecimento científico nas ações docentes, apesar de uma parcela significativa das professoras pouco ter corroborado à formação de um indivíduo cientificamente alfabetizado. **Conclusões:** Há a necessidade de fomentar ações voltadas à formação continuada de professores, em prol de mudanças significativas no âmbito escolar.

Palavras-chave: Ensino de Ciências da Natureza; Anos iniciais do Ensino Fundamental; Alfabetização científica; Conhecimento científico.

INTRODUCTION AND THEORETICAL CONTRIBUTIONS

According to Lorenzetti (2000), the teaching of natural sciences aims to provide access to scientific knowledge with an emphasis on the formation of the subjects to understand the specificities around them, positioning themselves and intervening in the face of the reality to which they belong. Moreover, when promoting access and mediation of scientific knowledge from the beginning of schooling, children are provided subsidies for the construction and attribution of the first meanings about phenomena that surround their reality, gradually developing their knowledge and culture, and the possibility of understanding it (Lorenzetti & Delizoicov, 2001; Viecheneski & Carletto, 2016). In this line, we realise that this corroborates the development of a critical and creative position on issues that imply the social, economic, technological, and environmental aspects that permeate society (Romanatto & Viveiro, 2015).

Researchers in the area highlight the importance of access to scientific knowledge since the beginning of schooling (Lorenzetti & Delizoicov, 2001; Viecheneski & Carletto, 2011; Sobreira, 2017; Kurz & Bedin, 2019b; and others). From this perspective, Fumagalli (1998) presents three justifications

for the teaching of natural sciences: access to scientific knowledge as a right of all; school commitment to promote this access; the teaching of sciences as a fundamental element for the formation of critical and participatory subjects in the society to which they belong. These justifications will be detailed below to deepen the discussions on the issue.

First, we point out that access to scientific knowledge is a right of all, including children as social subjects, and it is characterised as an imperative for their integral formation. In Brazil, science teaching is a right ensured by the Brazilian National Education Guidelines and Framework Law number 9.394/96, with school provisions and commitments. One of them is the access to information about science, understood as a process that contemplates curiosity, the search for explaining through observation, registering information, communicating of ideas, and proposing solutions (Brazil, 2012). According to the National Pact for Literacy in the Right Age, the teaching of sciences in the literacy cycle is constituted as spaces for learning, in which "the child's voice and thought are valued" (Brasil, 2012, p. 104).

Sciences in the initial years of elementary school (ES), in accordance with the National Common Curricular Base (BNCC), is structured in three thematic units, Matter and energy, Life and evolution and The Earth and the Universe, in which the objects of knowledge and skills to be developed are arranged, in the same way that it considers the specific competencies presented by area, and which should compose the subject's education during the first cycle. It is also necessary for the student to understand the objects of knowledge of the area as a human enterprise, and scientific knowledge as provisional, cultural and historical, and appropriate them to "[...] analyse, understand and explain characteristics, phenomena and processes related to the natural, social, and technological world [...]" (Brasil, 2018, p. 326).

Fumagalli (1998) shows in the second justification the school's duty to provide access to knowledge abouto the area, to socialise and disseminate scientific knowledge as provisional, cultural, and historically constructed, an aspect that must extend to the early years of the ES (Fumagalli, 1998, Viecheneski & Carletto, 2011; Sedano & Carvalho, 2017). Upon entering school, children have a set of knowledges of objects, materials, and phenomena that have already been developed in their daily experience in different social environments. Lorenzetti (2000, p. 31) adds that "in different situations before schooling, the child faced knowledge related to science, but it is in school that this knowledge will have the opportunity to be systematised, expanded, and contextualised."

Regarding the systematisation of scientific knowledge, it is noteworthy that this can happen in different ways and approaches in other teaching spaces. According to the curricular guidelines and guiding documents, the school must provide subsidies for the students' construction and appropriation of scientific concepts (Pires & Malacarne, 2016). The teaching and learning processes in science teaching should contemplate both the social context of the subjects and their prior knowledge and should be developed in the light of the instrumentalisation of the individual so that he/she can reflect and act responsibly in his space-time (Auler, 2007; Viecheneski & Carletto, 2016). Thus, "the child is not a citizen of the future, but is already a citizen today, and, in this sense, to know science is to expand its present possibility of social participation and enable its full capacity for social participation in the future" (Brasil, 1997, p. 22-23).

Regarding the third and final justification presented by Fumagalli (1998), it refers to the idea that the teaching of sciences is crucial to form critical and actively participatory individuals in a society (Fumagalli, 1998; Viecheneski & Carletto, 2011; Sedano & Carvalho, 2017). Lorenzetti (2005) points out that science teaching should promote the development of the subject for the full exercise of citizenship, stating that this area, based on its methods, its own language and its objects of knowledge, is essential for the students' integral formation, so that they assume responsibility as thinking and active beings.

Therefore, we understand the need for scientific education for all regarding access to scientific knowledge, which refers not only to an economic and social demand, but to a right of all, especially children (Marandino & Krasilchik, 2004; Cachapuz et al., 2005; Sedano & Carvalho, 2017). In contrast, although there is a consensus about how important scientific knowledge is in individuals' social practice, controversies are evident regarding the intrinsic value of this area for the early years of the ES. Faced with the dichotomy between discourse and action, we point out several factors that imply its effectiveness in the school environment (Fumagalli, 1998; Viecheneski, Lorenzetti & Carletto, 2015).

Among the obstacles to the promotion of science teaching for that level of education, the prioritisation of knowledges linked to portuguese language and mathematics to the detriment of science teaching is recurrent due to the requirement of a good performance of the respective areas (Delizoicov & Slongo, 2013; Kurz & Bedin, 2019a). We observe that teachers allow an exacerbated time for the learning of reading and writing, especially in the 1st

and 2nd years of the ES, when they could articulate the proposals for the development of the competencies mentioned above to the other areas of knowledges, especially those related to sciences (Sobreira, 2017). From this perspective, we believe that a pedagogical approach in the light of a given object of study, through the articulation of contents, can corroborate its comprehension in its completeness, overcoming the segmented approach to knowledge, an aspect that could cause a conflict in terms of time and space of teacher planning (Lledó, 1994; Nigro & Azevedo, 2011; Sobreira, 2017; Kurz & Bedin, 2019a).

In this process of teaching and learning the objects of knowledge related to the area, the role of school management stands out (Pereira et al., 2013) to foster the development of educational practices covering topics pertinent to the sciences. In other words, authors point out that science teaching is linked to objects of knowledge related to biology, disregarding the other disciplines that make up the area, even understanding that this set is essential to understand phenomena in nature (Sobreira, 2017; Kurz & Bedin, 2019a). We believe teachers prioritise the objects of knowledge associated with biology due to their lack of confidence about chemistry and physics, subjects that constitute, together with biology, the area of the natural sciences (Rosa, Perez & Drum, 2007; Giongo et al., 2016). These are important to the extent that we recognise that sciences teaching can "increase children's curiosity, encourage them to raise hypotheses and build knowledge about biological, physical, and chemical phenomena, about living beings, and about the relationship between man and nature and between man and technologies" (Brasil, 2012, p. 23).

The content approach is predominantly expository, centred on the teacher, and expects students to memorise concepts and describe phenomena. In contrast, an investigative work should prevail, based on identifying problems for the formulation of questions and possible solutions, providing the student with the correlation of the object of knowledge with phenomena surrounding their reality. This aspect, which conceives the subjects as the centre of the learning process, provides the articulation between the subjects' experiences and the concepts of science, enabling them to participate in the decision-making process actively and the development of a conscious and reflective posture in their context (Kurz & Bedin, 2019b).

Santos (2007) focuses on the implications in the science teaching and learning processes, since it predominantly limits the memorisation of words, formulas, and classifications, so that students have knowledge about the issue, but are unable to attribute meanings to the concepts. Lima and Maués (2006),

Rosa, Perez, and Drum (2007) and Ramos and Rosa (2008) point out the failing of the process of construction of scientific knowledge as a result of the educators' conception of science teaching in the early years, who suggest that students of this age group are still immature to understand scientific knowledge.

Even understanding the importance of science teaching in the early years, educators tend to prioritise teaching verbal and written language and mathematics, due to limitations, possibly related to limited initial formation, concerning the conceptual, methodological, and epistemological basis of the approach to scientific knowledges (Viecheneski, Lorenzetti & Carletto, 2012). The research points to the absence of science teaching for the early years, as the teaching action has provided few moments of dialogue about themes inherent to science (Santanna-Filho, Santana & Campos, 2011). Accordingly, Giongo and colleagues (2016), as well as Longhini (2008) and Santos (2007), point out the difficulty that educators have in approaching scientific knowledges in the early years, because:

> The reality of teacher education, which lacks reflection on science and its teaching, causes great uncertainty regarding developing scientific knowledge in the classroom; and results in a little or no innovative work, limited in many cases to reading or performing exercises proposed by the textbook that, no matter how well it is produced, contributes little to an attractive first contact of the child with the dynamic world of science. (Malacarne & Strieder, 2009, p. 76)

Another implication arising from the lack of confidence of the teacher who teaches science concerns the development of concepts, mainly due to gaps in their multipurpose qualification, since the workload directed to the study of this area in pedagogy courses is relatively low. As a way to meet those needs, the use of textbooks is resorted to, resulting in a superficial and static approach of the respective knowledges (Sobreira, 2017).

Ramos mentions the absence of infrastructure and pedagogical material and adequate space for classes (Ramos & Rosa, 2017). For Pereira (2016), this segment is associated with experiences in the teaching laboratory and, above all, in carrying out practical activities as a possibility for transcending the traditional method of teaching, based only on the use of the textbook for the approach and discussion of a given object of knowledge. It is noteworthy that only the demonstration of an experiment, based on an empiricist stance, will not contribute to the construction of scientific knowledge, since only the

observation of the phenomenon is insufficient for its full comprehension (Silva et al., 2012).

We focus our efforts on this area of knowledge because we understand that science teaching is a possibility for the promotion of scientific literacy in the early years, and this as a process in which scientific language acquires meaning, characterised as a possibility for the subjects to expand their universe of knowledge and culture as citizens belonging to a society. Agreeing with Sasseron (2018), we highlight that, although there is a significant discussion about the semantic polysemy of the expressions scientific alphabetisation and scientific literacy, we understand that the commitment and actions to carry them out are similar (Sasseron & Carvalho, 2016, Sasseron, 2018). Moreover, according to Krasilchik and Marandino (2004), scientific literacy is an already consolidated expression in social practice.

From the conceptions of Kurz, Bedin and Groenwald (2020, p. 696), we infer that the development of teaching and learning processes from a sociocultural approach to scientific literacy "is crucial for the constitution of critical arguments and the intensification of the student's logical reasoning, as it becomes an integral part of the learning process." We reiterate the need to cover both the students' previous knowledge and the cultural knowledge that permeates their community to re-signify knowledge and actively participate in the process of knowledge construction. Through a perception of the phenomena that permeate the world, we foster students' participation in the decision-making processes surrounding their community to be conscious, critical, and responsible for building a more just and egalitarian society.

This study, an excerpt of a master's research, *aims to investigate how the pedagogical practices of teachers of the 1st and 2nd grades of the ES contribute to promote access and the development of scientific knowledge to educate a scientifically literate individual.* This research is important to the extent that we believe that the teaching of natural sciences at that level of education "can be decisive for the initial scientific formation of students" (Pizarro & Junior, 2015, p. 209), since this consists of the children's first formal contact with scientific knowledge. In this perspective, the problem that guides this study is: *to investigate how the pedagogical practices of teachers who teach science in the 1st and 2nd grades of the ES contribute to the access and the attribution of senses and meanings to the object of knowledge approached aiming at educating a scientifically literate individual.*

METHODOLOGY

The data presented in this study[1] come from an investigation that adopts the assumptions of the ethnographic case study from a qualitative research perspective, to ascertain how the pedagogical practices of teachers of the early years of the ES contribute to promoting access and the development of scientific knowledge to educate a scientifically literate individual. Held in the second half of 2019, the research had the collaboration of a group of seven teachers of the 1st and 2nd grades of the ES, from three municipal schools of Vera Cruz/RS. This research intended to cover the different realities, and we decided to adopt the three schools, due to their representative character vis-à-vis the community.

It is noteworthy that a case study has as a premise to investigate the complex and contemporary phenomena present in the school environment in its natural context, which refer to the question of "how" and "why" they occur (Yin, 2015; André, 2013). We highlight that, through direct and prolonged contact with the natural environment in which the research takes place, the researcher seeks to understand the object of study by describing actions and behaviours aimed at this. Besides identifying the meanings attributed to the object, the researcher's premise is "to analyse interactions, understand, and interpret languages, study representations, without detaching them from the context and special circumstances in which they manifest themselves" (André, 2013, p. 97). Yin (2015, p. 17) adds that "the case study is an empirical investigation that investigates a contemporary phenomenon in depth and its real-life context, especially when the limits of the phenomenon and the context are not clearly evident".

By adopting ethnographic research principles in a case study, the investigation is complemented with a sociocultural perspective (Sarmento, 2011). That is, according to Sarmento (2011), the case study based on ethnographic assumptions provides, besides the cultural analysis of the object under investigation, the study from a critical and interpretative perspective of the symbolic and cultural phenomena that surround the context in which the respective educational institutions are inserted.

[1] The research project of this study was approved by the Human Research Ethics Committee under No. 15115919.9.0000.5349.

This is a qualitative research, since it is based on a "perspective that conceives knowledge as a process socially constructed by the subjects in their daily interactions, while acting in reality, transforming it and being transformed by it" (André, 2013, p. 97). After all, this differs due to the possibility of representing the positions and conceptions of the study collaborators to highlight the meanings attributed to the phenomena surrounding the given reality (Yin, 2016). Also, to give credibility to the data obtained in the process, the considerations regarding the object of study were based on the triangulation of the data obtained (Yin, 2016).

The information derives from observation of the school routine of the three institutions involved during approximately three months, described in a logbook, articulated to the responses to questionnaires composed of open and closed questions, semi-structured interviews with the teachers involved, and guiding documents of teaching practice - such as the Political Pedagogical Project (PPP) of all three institutions, and the notebook of one student from each of the classes where the teachers work. Through the triangulation of the information obtained, one has that "any discovery or conclusion in a case study will probably be much more convincing and accurate if based on several distinct sources of information, obeying a corroborative style of research" (Yin, 2015, p. 126).

Finally, the data analysis process occurred through the triangulation of information, which was interpreted in the light of Bardin's content analysis (2011). The premise of this method is to analyse a set of details through systematic objective procedures. Therefore, it employs a specific organisation throughout this process, which is structured in three specific and complementary phases, namely: *pre-analysis*, which consists of reading the documents, followed by the *exploration of the material*, emphasising the formulation of compilation units with decoding, classification and categorisation techniques and, finally, the *treatment of the results*, which, in turn, refers to the formulation of categories and explanations of the information obtained.

ANALYSIS, RESULTS AND DISCUSSION

Three public schools from significantly different contexts of the municipality of Vera Cruz RS participated in the research. We describe each context briefly according to the provisions of the PPP of each school to explain

the particularities of their sociocultural contexts. In this sense, to ensure their anonymity, the three schools were assigned letters.

School "A" is in the rural area of the municipality of Vera Cruz. Due to its geographical location, the institution student body is composed mostly of farmers' children. In this context, and by the PPP, School A school defends the formulation of a contextualised curriculum aligned with the demands of its surroundings, and fostering partnerships with the community and local entities to provide students with access and mediation of scientific knowledge through interaction and contextualisation aimed at forming subjects for the exercise of citizenship. However, it is important to highlight some local particularities that, according to the PPP, tend to influence students' cognitive and organic development negatively, such as tobacco cultivation, alcohol consumption, lack of perspective, and trivialisation of life.

School "B," in turn, is in the urban area, close to the city centre. According to the PPP, its premise is to form a critical, reflective, participatory, autonomous individuals, committed to themselves and the community where they are inserted. Although this school emphasises the importance of addressing issues that permeate the school context to corroborate the teaching and learning processes, the document brings little information about the particular elements of it, an aspect that tends to make it difficult to understand the perception of the school in relation to the demands and specificities of the school community.

School "C" is located in a specific neighbourhood in the urban area of the municipality of Vera Cruz. However, we underscore the complexity of the factors that permeate the school routine of students enrolled in that school, as many are in a situation of social vulnerability and experiencing risky circumstances due to contact with drug and alcohol users, violence, poverty, and social exclusion. Likewise, we observe the lack of family ties and the little commitment of parents and/or guardians to the subjects' learning, elements that tend to imply the high rate of failure and dropout and, consequently, the lack of prospects for the future, in relation to personal and professional objectives.

The same procedure was adopted for the collaborating teachers, which were identified as follows: School A: teacher of the 1st grade of ES (PA1) and teacher of the 2nd grade of the ES (PA2); School B: teacher of the 1st grade of ES (PB1) and teacher of the 2nd grade of ES (PB2); and School C: teacher of the 1st grade of the ES (PC1), teacher educator of the 1st grade of the ES (PEC1) and teacher of the 2nd grade of the ES (PC2). All teachers signed an informed consent, which documents the authorisation of research collaborators, due to the use and socialisation of relevant information.

During the development, we sought to investigate whether the pedagogical practices of the teachers of the 1st and 2nd grades of the ES of the three schools involved contributed to promote access and the development of scientific knowledge to educate a scientifically literate individual. Through logbook registers, we observed that few moments were assigned for the discussion of objects related to the sciences. The following are some of the registers made:

Table 1

Excerpts from the registers made during the observation.

TEACHER.	ANSWERS
PA1	She proposed the approach of questions about natural sciences in some of the classes observed. However, despite using different pedagogical resources, she finds it difficult to provide a challenging environment and encourage the students' participation and involvement to implement the proposal.
PA2	She was very concerned about an external Portuguese language and mathematics assessment scheduled for the 3rd quarter of the year, so she focused the classes on studying and carrying out questions related to those subjects.
PB1	All pedagogical planning is focused on the development of competencies and skills related to languages and mathematics, since we observed that issues involving natural or human sciences were not addressed. Performs constant assessments.
PB2	Teaching action based on knowledge transmission and reproduction. Diversification of activities or proposals to approach objects of knowledge is not observed. Likewise, she little encourages the students' participation and dialogicity in the teaching and learning processes.
PC1	Although this teacher did not provide access and mediation of scientific knowledge, considering the teachers' group, she seems to understand the context in which the school is inserted, i.e., using some questions in the proposals and activities developed in the class.
PEC1	Although with significant difficulties in approaching scientific knowledge, possibly because she is still in the process of initial formation and has little experience in that level of education, in a way, she provided discussions on issues linked to the area of the natural sciences.
PC2	Teaching posture somewhat authoritarian. Therefore, she little encourages the students' participation and involvement in the

process of knowledge construction. Another characteristic aspect of it is the "award" for activities carried out with commitment and dedication; however, such action was carried out quite frequently, often causing in a hostile environment and based on competition between the subjects involved.

We observed that pedagogical practices aimed at approaching objects of knowledge related to the area of sciences were occasional, since, throughout the observation period in the six classes, only two teachers (PA1 and PEC1) provided, at specific times, access and mediation of scientific knowledge. In one of the classes observed, PA1 proposed the discussion on the theme "Diversity." By proposing a discussion circle, and using literature and children's songs, PA1 sought to encourage the students' participation and involvement during the process. PEC1, a preservice teacher of the 1st grade class of ES - who was doing the compulsory curricular supervised practice during our research - proposed a project involving the theme "Animals." To address such knowledge, PEC1 only read the materials, evidencing her lack of confidence concerning the theme developed, which resulted in little students' participation.

Another aspect that emerges in Table 1 refers to large-scale external assessments, such as the Basic Education Assessment System (SAEB) PA2 mentioned, since we assume that it corroborates the scenario. In this context, the authors Tolentino-Neto and Possebon (2013) point out the discrediting of the area of the sciences in SAEB, since this assessment aims to diagnose the quality of teaching by collecting data from educational institutions.

Based on the observations of PB2 classes, it is noteworthy that the teaching and learning processes, regardless of the area, are based on the student's passivity and the transmission and reception of knowledge. This statement is justified when we perceive that PB2 did not use a set of strategies and proposals to approach a given knowledge, nor did it foster students' dialogue and involvement in the teaching and learning processes. Therefore, it contributed little to forming a scientifically literate student, since PB2 did not promote conditions for the student to attribute senses and meanings to the objects under study.

The registers made in the observation space-time refer to the idea that teachers (PA2, PB1, PB2, PC1, PC2) focused their pedagogical practices on developing competencies and skills in the areas of languages and mathematics, with specific exceptions. This prioritisation of specific areas to the detriment of

the other curricular components is also suggested in several studies in the area (Lorenzetti & Delizoicov, 2001; Kurz & Bedin, 2019b). This entails significant implications for the formation of the subjects, since it has contributed little to the access to scientific knowledge at a crucial stage of their development. We must reflect about teaching practice and its posture in the face of the teaching and learning processes, i.e., its conceptions respecting the possibilities and strategies to promote access and development of scientific knowledge to contribute to form "critical, conscious citizens, able to read and interpret the world, their context, and thus give rise to decision-making in a perspective of transformation" (Lorenzetti, 2000, p. 63).

Note that the comment above is not only typical of the observation period. It is also extendable to the school year, since we observed the same pattern of information by analysing the students' notebooks and materials. Table 2 shows the answers that derive from this question[2].

Table 2

Teachers' expectations in terms of competencies and skills for the school year.

TEACHER.	ANSWERS
PA1	I expect that by the end of the 1st-grade students will be able to read and write small texts or sentences, use logical reasoning, count and write numbers up to 30 or more, feel they are transforming agents of their reality.
PA2	That the whole class can read fluently, produce texts, and solve mathematics problems.
PB1	That my students go out reading, writing, interpreting, knowing and writing numbers up to 100, performing calculations of addition and subtraction, solving simple everyday problems, etc.
PB2	That they read well, understand what they have read. Produce texts with logic and sequence. Recognise the numerals (all thousands). Solve mathematical stories and have good verbal expression.
PC1	Handle competencies and skills required by the BNCC.
PEC1	During their supervised practice time, it was to know the animals, their characteristics, through them, learn to write, read and perform mathematical operations, also basic rules of respect, care.

[2]The excerpts in the tables presented throughout the text are identical to those presented by the research collaborators; therefore, their writings were not translated and organised so as to distinguish the essence of their placements.

PC2	The students can at least participate in oral exposure situations, plan their speech properly, read different textual genres; write, considering their textual production.

Although implicitly and recurrently to the detriment of other areas, there is evidence of science teaching in PA1's and PEC1's responses. In PA1's speech, she indicates the need to form individuals to exercise citizenship, so that they act as agents that transform the reality in which they are inserted. PEC1 presents competencies and skills specific to sciences as drivers in the development of objects of knowledge from different areas. According to these teachers' statements, and according to the provisions of BNCC in the face of such premises, they are expected "to enable these students to have a new look at the world around them, as well as make conscious choices and interventions" (Brasil, 2018, p. 321). In this context, the logbook registers show reflections of these placements in these teachers' pedagogical practice, since they provided moments focused on the discussion of scientific knowledge.

According to the answers in Table 2, it is evident that teachers' actions are focused on the development of competencies and skills with emphasis on the areas of languages and mathematics, since they show excerpts such as "reading fluently, producing texts, and solving mathematics problems" and "That my students go out reading, writing, interpreting, knowing and writing numbers up to 100 [...]. It is also necessary to highlight PC1's standpoint, since she affirms the development of competencies and skills specified in the BNCC. However, when asked about this standpoint in the interview, she presented answers similar to the other teachers, referring to expectations exclusively in mathematics and languages.

Thus, the teachers were asked about their reasons for prioritising these areas. As an example, we highlight teacher PB1's answer, which, in a way, represents all the aspects that arose from this question:

> There would be several essential contents in the human beings' lives that should be addressed, I will not cite them now, but let us not forget that the teacher is overwhelmed with contents to be developed in all areas and it is difficult to account for everything in a year (PB1's response).

Therefore, although she understands the importance of access and mediation of scientific knowledge for the subjects' education, PB1 emphasises that she is overburdened by demands in terms of the objects of knowledge she

must develop during the school year. Likewise, PB1 also mentions the daily demand either by the pedagogical coordination and/or direction of the school or by large-scale external assessments, including parents and/or guardians' expectations who, in turn, want their children reading, writing, and calculating by the end of the 1st grade.

Resuming the discussion about the teachers' conceptions, since they understand the importance of teaching science, we questioned "why" and "what for" teaching science in the 1st and 2nd grades of the ES. Table 3 brings the responses obtained.

Table 3

Why and what for teaching natural sciences in the early years.

TEACHER.	ANSWERS
PA1	To try to make the students transforming agents of the reality in which they live: able to take care of themselves, the people they live with, and the environment in which they live.
PA2	To have a broad knowledge about nature, body.
PB1	Science allows the students to get to know themselves better and know the world around them. It encourages and instigates curiosity and interest in better knowing the phenomena and natural elements of their daily lives and respecting them, learning to value and preserve them.
PB2	Precisely because they are always current content and students like it.
PC1	Because of the importance that science has in everyone's life.
PEC1	It is important to teach science in a way that instigates them to want to learn more. It begins by teaching one own's body, living beings, the world around us. Teaching them to respect, take care of themselves, the environment...
PC2	Because children have the right to learn science. For the student to become the subject of their learning, to reflect, contextualise, promoting knowledges of home, the streets, and the social group, relating it to the school environment.

There are several pertinent considerations about the motivations and purposes of science teaching at the beginning of the schooling process, such as the individuals' ability to take care of themselves, the people they live with, and their environment (PA1, PB1 and PEC1). PB2 also points out that the objects

of knowledge of this area constitute themes of interest, considering the group of subjects with whom she works. This approach enables the teacher to encourage and instigate students' participation in the teaching and learning processes. PA2 presents an answer based on conceptual knowledge of the human body and nature, while PC1 emphasises the importance of the area for the formation of the individual, although she has not detailed her justifications.

The PC2 emphasises that science teaching is a right of all, including children. Marques and Marandino (2018) reiterate children's inclusion as subjects of rights in the scientific literacy process. We argue for the need to break with the idea that the children are unable to understand scientific knowledge, so, according to PC2, children become the subject of their learning and educational process. It is essential to promote the successful inclusion of these subjects through actions based on dialogue "with childhood cultures, which involves the adequacy of times and spaces, the presence of multiple languages, the playful dimension, the imaginary and interaction" (Marques & Maradino, 2018, p. 15).

Fumagalli (1998) points out that the children have the right to learn scientific knowledge, while the school must teach or even guide the process of seeking information, and the most appropriate place to perform it. For the author, "not teaching science in early ages invoking a supposed intellectual disability of children is a way to discriminate against them as subjects" (Fumagalli, 1998, p. 15). In this line, we assume that part of the teachers' group has a significant view of the commitment and importance of the area for the subjects' formation. Teachers recognise that science teaching aimed at understanding the world, as a possibility to promote, from the early years, the students' scientific literacy, must be fostered. Through access and mediation of scientific knowledge, the students will be able to reflect on this knowledge, in the sense of reading and interpreting their social environment and acting consciously and responsibly under it (Ovigli & Bertucci, 2009).

The teachers were also asked about the objects of knowledge necessary to be developed in the 1st and 2nd grades of the ES, which tend to contribute to the understanding of the elements that permeate the world. The answers are shown in Table 4.

Table 4

Objects of knowledge that must be addressed in the 1st and 2nd grades.

TEACHER.	ANSWERS
PA1	I believe the environment, and the function we have to take care of it; Animals (Fauna) and plants (Flora); Human body (Parts, hygiene, vaccination, the function of each part; healthy eating...; Notions of time (Calendar (days, months, years, seasons)).
PA2	Nature preservation, body care.
PB1	As I said earlier, it is difficult to work with science in the 1st grade, before literacy, but usually, in the second semester, I can work on the human body, animals, plants, preservation of the environment, water, and garbage.
PB2	Basic concepts combined with literacy.
PC1	Basic information on the human body, animals.
PEC1	It is necessary because it helps the child be aware of the importance of caring for nature and preservation. Have notions of how to preserve and care for the environment.
PC2	Questions made about the environment and nature itself, to travel paths previously traced through discoveries, observations, experimentation, problem solving, improving the scientific method.

We can observe that School B teachers' responses are similar, since both discourses bring literacy-related elements. As objects of knowledge, PB1 highlights themes such as the human body, animals, plants, preservation of the environment, water, and garbage, and emphasises the difficulty of providing an approach to such knowledge, even before the individual's literacy. In contrast, Freire (1986, p. 11) is mentioned: "the reading of the world precedes the reading of the word." In this contribution, it is possible to promote access and development of scientific knowledge regardless of the appropriation of alphabetic writing (Lorenzetti & Delizoicov, 2001; Marques & Marandino, 2018).

PB1 claims to develop the activities, but there was no evidence of studies on this area of knowledge, nor actions and proposals aimed at the objects mentioned. Only in November 2019, when we conducted the teachers' interviews, did PB1 claim to have started studying the human body. Therefore, the students of the 1st grade of the ES were not offered the gradual approximation of the main processes, practices, and procedures characteristic of scientific research (Brasil, 2018). At the same time, there was no intradisciplinary work involving the different areas of knowledge, as the PPP of the educational institution reiterates.

PA1 presents a set of objects of knowledge that are quite significant, considering the area of sciences somewhat aligned with the BNCC.

Considering a 1st grade class of the ES, the objects of knowledge are associated with two thematic units, namely "Life and evolution" and "The Earth and the Universe", except for the thematic unit "Matter and energy," which was not included in the teacher's speech, since she does not mention the study of the characteristics of materials or objects of related knowledges (Brasil, 2018).

PA2, PC1, and PEC1 present more generic considerations, specifying only human body issues, studies on animals, and nature preservation. PC2, in particular, does not give a clear answer to the questioning. The teachers emphasise that teaching practice must promote situations in which students can analyse, make remarks, discuss the theme, propose alternatives, and socialise possible solutions, i.e., help students to go through the stages of the scientific method.

It is noteworthy that the approach to scientific knowledge should be structured in such a way as to include, besides the conceptual contents related to this area, attitudinal, and procedural contents. According to Viecheneski and Carletto (2013), the teaching action should focus on the children's development, to corroborate the predominance of everyday concepts, guiding their process of construction and systematisation. To this end, this action requires teachers to understand the children's world, concerning their ways of "thinking, saying, and learning" (Viecheneski & Carletto, 2013, p. 223)

Another question was about the aspects that should be considered when approaching objects of knowledge of science. Table 5 shows the answers derived from this question.

Table 5

How to promote the approach to scientific knowledge in the 1st and 2nd grades.

TEACHER.	ANSWERS
PA1	In the 1st grade, I try to work the human body (visible parts); hygiene habits, phases of life, notions of time (morning, afternoon, night, days, months and years); use of the calendar; care for the environment. Through conversations, music, videos, books, internet searches, textbook activities...
PA2	As this teacher does not teach science classes, she did not answer this question.
PB1	Human body (main parts). Conversation about the human body; each student looked at him/herself in the mirror and observed him/herself. Drawing on brown paper (A child lies down and contours her body;

	complete with the parts of the face, put the name of the main parts); Music: (Head, shoulders, knees and toes); Sheet activities. Everyone watches and participates.
PB2	Oral introduction of the subject, theory in the book, or copy and some practice related to the content.
PC1	Through images, music, writing, field trips, film...
PEC1	Working on living beings, talking about the law that protects animals from abuse...
PC2	About garbage: learning from a young age to use the school's garbage bins and not to contaminate the environment, for example, by bringing batteries and cell phones to the correct trash can in our school.

PA2 declared not to develop science classes in the 2nd grade of ES and chose not to answer this question. Teachers PA1, PB1, PB2, and PC1 claim to use different pedagogical resources to approach scientific knowledge, such as music, children's literature, videos, internet searches, movies, field trips, drawings, textbooks, etc. The possibilities listed by the group of teachers are relevant, since from the development of such strategies the teaching action will be providing an education aimed at the student as the protagonist of the formation process to the extent that it fosters curiosity, active participation, and the desire to learn (Viecheneski & Carletto, 2013).

According to Lorenzetti and Delizoicov (2001), the use of children's literature is a possibility to promote discussion about the meanings that permeate the scientific conceptualisation present in the discourses that compose the media. Nevertheless, the authors state that field trips provide students with direct observations "contributing to scientific literacy, insofar as they allow, in a systematic way, to mediate the use of knowledge to understand better real situations" (Lorenzetti & Delizoicov, 2001, p. 55). The use of textbooks raises much criticism, since it is associated with teachers' lack of confidence in approaching scientific knowledge. However, it is noteworthy that its use, together with other tools, can be useful for the teaching and learning processes, to explore their potential and highlight their limitations as a resource, being necessary to articulate the discussion with other pedagogical instruments.

Although PEC1 does not describe the approach she adopted to promote access and the development of scientific knowledge, she emphasises the need to dialogue on the theme of "living beings," and on the law to protect them from animal abuse. In the interview, PEC1 highlights the relevance of this discussion due to episodes of this nature in the school community vicinity, thus articulating

scientific knowledge with issues present in students' daily lives. PC2, in turn, reiterates the need to foster discussions about waste, emphasising the classification of waste, such as battery and cell phones, as they are highly toxic and cannot be discarded incorrectly. However, despite what teacher PC2 affirmed, no actions aimed at such processes were observed, and there were no registers in the students' notebooks. Furthermore, it is noteworthy that at some moments, PC2 underscores that the school has selective collection; therefore, there are specific collectors for the materials mentioned, which are difficult to discard.

Those actions are essential to the extent that we believe that the memorisation and description of a respective phenomenon do not refer to its understanding - since understanding a given object of implicit knowledge and correlated to a phenomenon necessarily implies to establish relations between knowledge and context through a dialogic process in which innate curiosity is permeated with a view to the subjects' epistemological curiosity (Marques & Marandino, 2018). Therefore, it is necessary to promote pedagogical strategies in which students can understand and articulate scientific knowledge in everyday situations, to corroborate the development of a scientifically educated subject (Lorenzetti & Delizoicov, 2001).

We reiterate that even with the BNCC implementation in ES, we observe a specific set of objects of knowledge starting to be addressed in the classes, regardless of the school in which they are. However, although provided for in the different PPPs, only in specific moments did we observe the contextualisation of knowledge in the teachers' pedagogical practice, the approach of an object of study from phenomena surrounding the students' reality, or through the experience of the students of the community. Moreover, because they are characterised as singular contexts and with potential for discussions, schools – teachers as well - have the competencies and skills to provide students with an understanding of their surroundings. Based on the sciences theoretical and epistemological contributions, students can be transforming agents of the reality in which they are inserted, to improve their quality of life and of their community.

We could only observe actions aimed at promoting access and the development of scientific knowledge in the 1st and 2nd grades of the ES due to several issues. The information provided in this section revealed that only two teachers in the group provided, at specific times, access and mediation of scientific knowledge in the classes for which they are responsible. In contrast, based on the registers collected in the routine observations, in materials,

notebooks, and books of each class representative, we found no evidence that the other teachers' pedagogical practices included the study and discussion of knowledge related to that area. From this perspective, we reiterate that, with some exceptions, the teachers' pedagogical practices have contributed little to students' access to scientific knowledge and systematisation and appropriation of objects of this knowledge, hindering the students' formation towards scientific literacy.

Likewise, besides not having included the discussion of knowledge related to the area of sciences in the teaching practice, part of the teachers, in approaching a given object of knowledge, little encouraged the dialogue and/or problems and discussion about a given content or the students' active participation in the teaching and learning processes. Thus, the students assume a passive posture throughout the process. Therefore, with specific exceptions, in the face of such a scenario, the teaching action hardly contributed to the formation of critical students in the light of the scientific literacy process. In this strand, we understand that during continuing education, teachers' tend to guide their pedagogical planning concisely, aiming to collaborate to promoting access and mediating knowledge - which must be presented gradually, taking into account the particularities of each teaching step, so that the use of different teaching strategies can foster the students' involvement in the process of building their knowledge.

FINAL CONSIDERATIONS

The pedagogical practice developed by teachers who teach science in the early years, considering the group mentioned, contributes little to promoting access and development of scientific knowledge in the early years of the ES in the light of the education of scientifically literate individuals, with specific exceptions, as in the case of teachers PA1 and PEC1. Given the context, we sought to ascertain the collaborating teachers' conceptions regarding expectations, in terms of competencies and skills to be developed throughout the school year, considering their respective classes; the motivations and purposes of science teaching in the 1st and 2nd grades of the ES, which objects of knowledge should be contemplated at these levels, and how to approach those objects. In other words, we sought to identify the senses and meanings teachers' attributed the requirements above, to use this information to structure actions aimed at continuing teacher education so that the discussions provided in these spaces are extendable to teaching practice.

In this sense, given the research findings, we propose as derivations of this study the organisation of actions aimed at continuing teacher education to promote moments for reflection on teaching practice, especially concerning science teaching in the early years of ES. Promoting access and mediation of scientific knowledge at this stage is essential to students' scientific education, as they refer both to the children's first formal contacts with scientific knowledge and the fact that they experience a stage permeated by an innate curiosity about the phenomena that surround their reality. Thus, it is essential to promote spaces focused on dialogicity and dynamism of proposals and contextualise scientific knowledge in such a way that the child can attribute senses and meanings to knowledge.

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All authors actively participated in the discussion of the results, reviewed and approved the final version of the work.

DATA AVAILABILITY STATEMENT

Availability at reasonable request: The authors agree to make the research data available at the reasonable request of a reader.

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