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ANALYSIS OF TEACHING ABOUT SOILS IN GEOGRAPHY IN STATE SCHOOLS OF FRANCISCO BELTRÃO/PARANÁ

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ABSTRACT
The Soils content is a subject that is little considered in basic documents used for the elaboration of schoolbooks. As a result, the study of this natural resource is not always presented with its due comprehensiveness to the students in the classroom. Thus, this article aims to highlight how Soils studies and their conservation have been developed in the school, both in Elementary and High School, in Geography subject. To this end, questionnaires were used with Geography teachers from State Schools in the town of Francisco Beltrão-PR, to analyze the methodologies used to work with the Soils theme, and questionnaires with 6th grade and 1st grade High School students, to analyze the teaching learning process. Analyses of documents such as PCN (2003) and BNCC (2017) were conducted to understand the formulation process of schoolbooks and how the Soils content is present in schoolbooks. Also, analysis of the schoolbooks of the elementary and high school years was conducted to observe the arrangement of the content under study. This information was useful to understand the teaching-learning process with students and teachers and the importance of this resource as content in the schoolbooks.
Keywords: soil; soil education, geography teaching

ANÁLISE DO ENSINO SOBRE SOLOS NO ENSINO DE GEOGRAFIA NAS ESCOLAS ESTADUAIS DE FRANCISCO BELTRÃO/PARANÁ

RESUMO
O conteúdo de Solos é um tema pouco abordado em documentos básicos utilizados para a elaboração dos livros didáticos. Em consequência, o estudo sobre esse recurso natural nem sempre é apresentado com a sua devida abrangência para os alunos em sala de aula. Dessa forma, esse artigo tem por objetivo destacar como os estudos sobre Solos e a sua conservação vem sendo desenvolvidos no espaço escolar, tanto no Ensino Fundamental como no Ensino Médio, na disciplina de Geografia. Para isso, foram aplicados questionários com professores da disciplina Geografia de Escolas Estaduais no Município de Francisco Beltrão-PR, para analisar as metodologias trabalhadas com o tema de Solos, e questionários com alunos do 6º ano e 1º ano do Ensino Médio, para analisar o processo de ensino aprendizagem. Foram realizadas análises dos documentos como PCN (2003)e BNCC (2017) para compreender o processo de formulação dos livros didáticos e de que forma o conteúdo Solos está presente nos livros didáticos. Também foi realizado análises do livros didáticos dos anos do Ensino Fundamental e Médio para observar a disposição do conteúdo em estudo. Essas informações foram úteis para compreender o processo de ensino aprendizagem com os alunos e professores e a importância desse recurso como conteúdo nos livros didáticos.

Palavras-chave: solo; educação em solos, ensino de geografia

INTRODUCTION

The natural soil resource has several concepts used in the daily lives of people with different professions. Our ancestors considered soil as a layer that covered the Earth's surface, through which man moved and used the pigment for the representation of their daily lives on cave walls - the cave paintings (Lepsch, 2010). For farmers, soil is essential for food production. The civil engineers use it as a raw material, used in the construction of roads, dams and embankments. Pedologists analyze this material in a different form, observing its layers, minerals, texture, color, porosity, among other information that helps in research, especially about its origin and evolution (Santos et al., 2013). Historians and archaeologists interpret soil as a laboratory of discovery. Plants take essential elements from the soil for their development. On the other hand, plants and living beings that live in the soil fix their roots and contribute to the proper functioning of the soil (Brady & Weil, 2013)

From a conceptual point of view, soil is the natural non-renewable layer of unconsolidated material, composed of minerals and organic matter, distributed between the atmosphere and the lithosphere (Brady & Weil, 2013). It is the space where flora germination, water infiltration and habitat for small animals (Galeti, 1972). Its mineral part is formed by pebbles, grains, sand, silt and clay of different origins, such as volcanic, sedimentary or metamorphic rocks. Its organic part, on the other hand, consists of living beings or decomposition that provides nutrients necessary for soil fertility and use (Lepsch, 2010).

In addition to water, air, and sunlight, soil is considered fundamental for an ecosystem to develop, since it is the resource responsible for plant growth, temperature control, biodiversity formation, and food supply for humanity and animals (Brady & Weil, 2013). It is a non-renewable resource, and its formation process is slow and continuous, requiring about 400 years to form 10 centimeter of soil (Embrapa, 2006). Besides this, several pedogenetic factors and processes are necessary for its development. It is commonly seen as lifeless, abiotic material. This idea hinders the view of the importance of soil for humanity.

Soils are the habitat of much of the biodiversity, being responsible for the conditions for survival. Earthworms, ants, fungi, and centipedes move around, forming channels that help water infiltrate the profile, exchange gases, and facilitate root distribution. In it turn, the soil depends on these organisms for the decomposition of organic matter and the cycling of nutrients and water. The loss of diversity reduces the ability to regulate the composition of the atmosphere, temperature, erosion, and the climate, as well as its role in mitigating global warming (Costa, 1991).

There is an interdependence between plants and soil. While the soil is responsible for promoting growth, sustaining, and providing nutrients necessary for the development of plant roots, plants collaborate in the addition of plant remains, support, and soil quality. With their roots, plants contribute to the loosening of compacted soil and serve as a strip that holds the soil, preventing mass movement processes, such as landslides on hillsides. Organic matter is beneficial to both soil and plants, because the leaves, branches and fruits increase the vegetation cover, protect the soil, and contribute to increased fertility, release

chemical elements such as carbon and hydrogen, which are stored and are essential for the development of life in the soil (Doran, 1996)

It is the soil that the farmer uses to produce food and fuel for countless families around the world. For this, this soil needs to be fertile, with the necessary nutrients for the good development of the plants. But, with the need for accelerated production, vast areas are being deforested to increase agricultural production. This results in degraded soils, loss of biodiversity, and excessive use of fertilizers and pesticides (Embrapa, 2006).

Thus, during the academic course, especially during the supervised internship activities in state schools in the city of Francisco Beltrão, Paraná, it was noticed that the contents related to Physical Geography are worked using only the schoolbook as a bibliographic source.

Especially on the content soils, the schoolbooks bring an even more superficial approach. Thus, this article seeks to present an analysis of how the soil content is dealt with in greater depth in Elementary and Secondary Education in State Schools in the city of Francisco Beltrão - PR, with special emphasis on the issue of soil conservation.

MATERIAL AND METHODS

The city of Francisco Beltrão is located in the Southwest region of the State of Paraná, South of Brazil (Figure 1). With a population of approximately 93,000 inhabitants, the city is the largest in the region with infrastructure in health, education, and economy to meet the population of cities in the region (IBGE).

The economic base of the town is agriculture and dairy production. Family farming has a high visibility in local commerce, with productions of jams, jellies, varieties of vegetables and greens, which are sold in fairs in various locations in the city (SCHMITZ, 2014). With this, a large part of the students who study in state schools in the city reside or have family members in the rural area of Francisco Beltrão. The contact of many teenagers with the soil is frequent since many collaborate in rural work with their families.

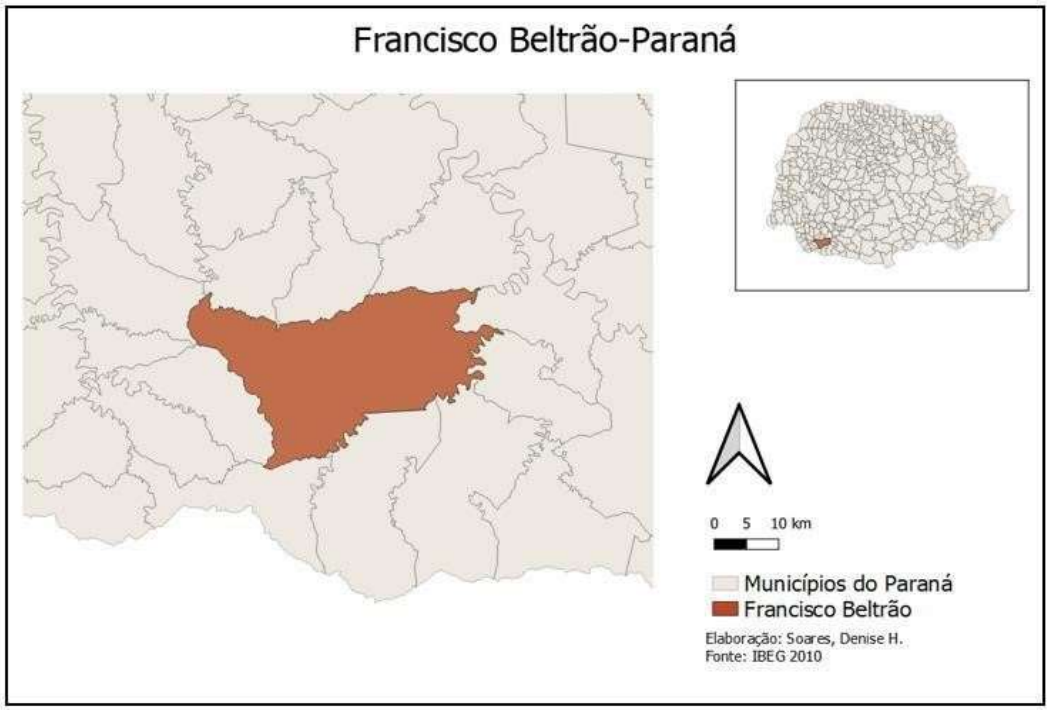


Figure 1: location of the town of Francisco Beltrão-Paraná.

The research was conducted with teachers and students from elementary and high schools in the urban area of Francisco Beltrão (figure 1), through the application of a questionnaire online through Google Forms, because of the Covid-19 pandemic, which made it impossible to conduct questionnaires in person at the school. This questionnaire sought to obtain information that would make it possible to analyze how the teacher works with the content in the classroom and what tools and methodologies are used during the classes. In addition to the questionnaire, an analysis of schoolbooks from the 6th year of elementary school to the 3rd year of high school and an analysis of the PCN (2003) and BNCC (2017) guidelines was carried out to verify the arrangement of the content on Soils and better understand the formulation process of this content by the schoolbook authors.

To begin the research, an analysis was conducted on the documents and guidelines that guide the preparation of schoolbooks for public schools in Brazil. The documents analyzed were PCN (Parâmetros Curriculares Nacionais,2003) and BNCC (Base Nacional Comum Curricular,2017). The objective was to verify the arrangement of the content about Soils and to better understand the formulation process of this content by the authors of the schoolbooks.

The analysis of the occurrence of soil content in Geography schoolbooks for Elementary and High School was carried out in copies from three publishers, totaling 18 schoolbooks. The objective was to verify the comprehensiveness of the existing content in the books, considering the student's learning regarding the formation and evolution of soil itself, as well as its importance in the balance of the physical environment and its conservation.

To better understand how teachers work this content in schools, a questionnaire was prepared with 11 questions regarding the methodologies used and the didactic resources that complement the material available in the schoolbooks. This questionnaire was sent to a total of 45 Geography teachers who teach in State Schools located in the city of Francisco Beltrão, Paraná (Figure 2). Of this total, 30 teachers returned the questionnaires.

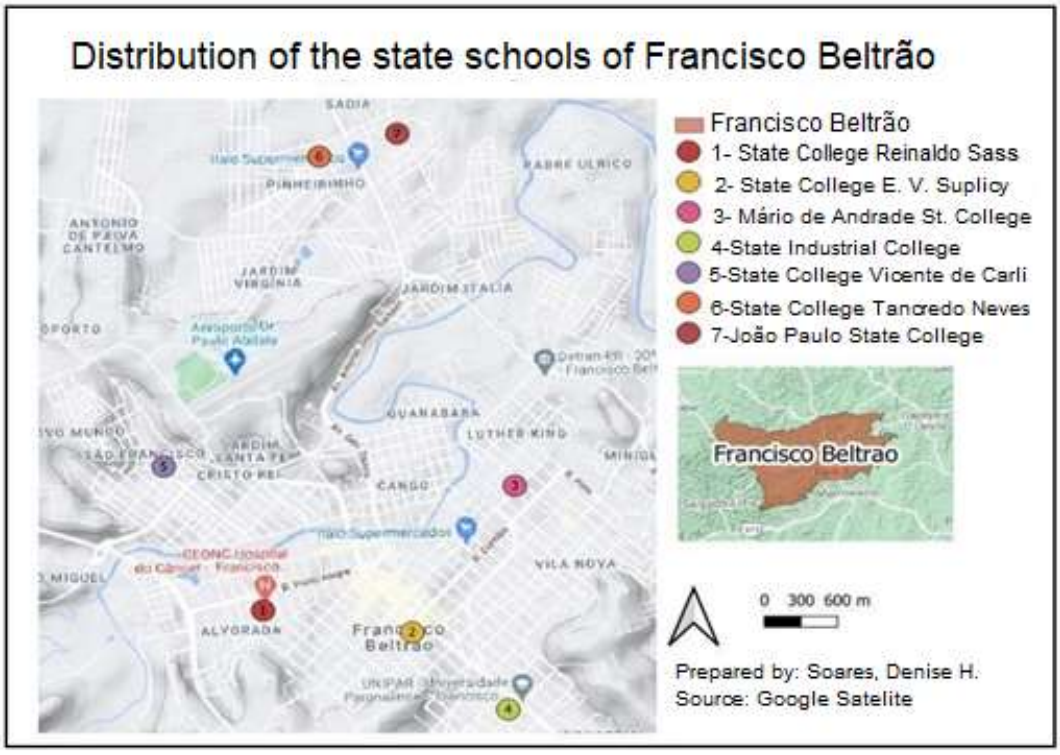


Figure 2: Distribution of the State Schools in Francisco Beltrão, where the teachers teach.

To understand the learning process and if the methodologies used in the classroom are sufficient for student learning, a questionnaire was applied to 25 6th grade elementary school students and 35 1st grade high school students from the same schools, totaling 60 questionnaires answered.

RESULTS AND DISCUSSION

THE CONTENT ABOUT SOILS PRESENTS IN THE PCN AND BNCC DOCUMENTS

The National Curricular Parameters are guidelines that aim to assist the elaboration of content in schools all over the country. They are proposals that schools can base their own teaching plans on. The PCNs are related to the National Education Plan (PNE) of the Ministry of Education (MEC) to propose an education that reaches all students, respecting citizenship, equal rights, and regional and cultural diversity.

The Common National Curricular Base is a normative document that defines the organic and progressive set of essential learning that all students should develop throughout the

stages and modalities of Basic Education. It ensures the learning and development rights, according to the PNE (LDB, Law 9.394/1996).

By analyzing these main basic documents for the construction of the curricula for basic education in Brazil, one notices that little is mentioned about contents related to the study and conservation of soils.

One of the objectives that the PCNs indicate in Elementary School is "that students are able to perceive themselves as integrating, dependent and transforming agents of the environment, identifying its elements and the interactions between them, actively contributing to the improvement of the environment. Thus, the parameters to be worked with students are always presented in a composite way about the environment, making a set about water conservation, nature, trees, and very little about soil conservation (LDB, Law 9.394/1996).

The scarcity of soil content in the objectives and competencies of these guidelines causes a rupture in the teaching and learning process of the student, in most cases, the schoolbook is used as the only tool to work in the classroom. The superficial way in which this theme is discussed by schoolbooks and schoolbooks does not show the importance of soil, being studied in a superficial way by the students.

Without having a solid base in the documents with soil-related contents, the school and the teacher have the fundamental role for this theme to be worked with its due importance, presenting the human dependence on it and the consequences of not having this fertile resource for life on Planet Earth.

SOIL CONTENT IN SCHOOLBOOKS

When one checks the arrangement of soil-related content in the schoolbooks, it appears in the 6th grade and 1st year of high school in all the publishers studied (Table 1). The theme is shown in the same way at the different levels of education. The process of soil formation and the factors involved in its formation and, briefly, its conservation are discussed. The totality of this information does not exceed 2 pages, in books with more than 200 pages.

In schoolbooks for 9th grade, the importance of soils is addressed in the item on Environmental Education. According to Muggler et al. (2006), Soil Education allows this resource to be observed and used differently in people's lives. Understanding the importance of its conservation, as it is a familiar material, enables a more meaningful learning, and may constitute an instrument in Environmental Education.

The content shows the consequences of a degraded soil and the ways of conservation, in a quick and unnoticed way. The publisher FDT was the one that presented the most content about soils in its books, giving more emphasis to the issue of conservation and the consequences of improper management of soil, both in the 6th grade and 1st grade books.

Table 1: Occurrence of soil content in primary and secondary school schoolbooks

Publisher	Edition and year	Authors	collection	presents content	no content	just as a quote
FDT	1st edition 2012	James Onning Tamdjian e Ivan Lazzari Mendes.	Studies for the understanding of space	6th grade / 1st year	7th grade / 8th grade / 2nd grade	9th grade / 3rd year
Moderna	2nd edition 2016	Angela Corrêa da Silva, Nelson Bacic Olic e Ruy Lozano.	contexts and networks	6th grade / 1st year	7th grade / 8th grade	9th grade / 3rd year
Saraiva	3rd edition 2017	João Carlos Moreira e Eustáquio de Sene	geographic space and globalization	6th grade / 1st year	7th grade / 2nd grade / 3rd grade	8th grade / 9th grade

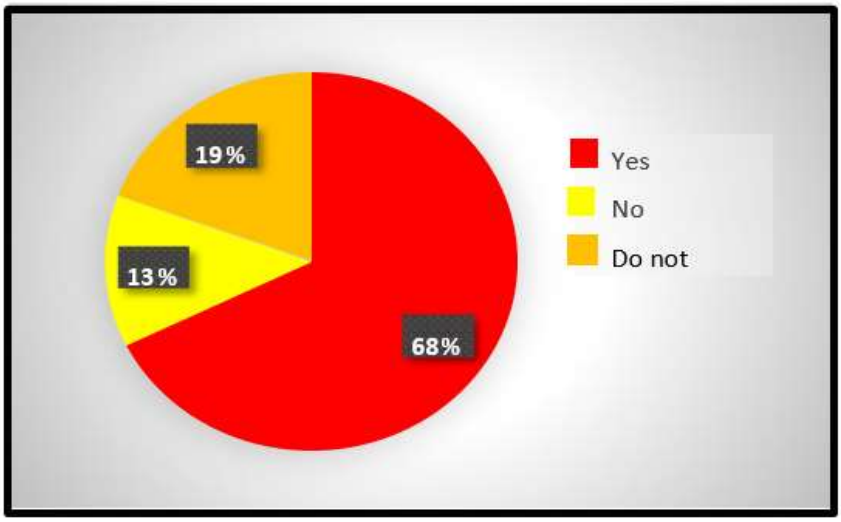
Source: Organized by the author-2021

The analysis of the content of soils in schoolbooks makes it clear how this topic goes unnoticed when the schoolbook is being formulated. This is because in the basic documents for the elaboration of schoolbooks, the content of soils is not relevant. Once it is briefly presented in the schoolbooks, the soil content in the classroom will be worked by the teacher as briefly as possible. As a result, there is a rupture in the teaching of the environment, specifically with regard to the natural resource soil.

HOW TEACHERS WORK THE SOIL CONTENT IN THE STATE SCHOOLS IN THE CITY OF FRANCISCO BELTRÃO- PR

The first information obtained from the questionnaire applied to the teachers was whether they had studied soils content during their academic education. Of the total interviewed (30 teachers), 21 said yes, 4 teachers informed that they had not studied soils in their higher education, and 6 teachers did not remember (Graph 1). This information contributes significantly to understanding the methodologies that teachers use in the classroom. Regarding the level of education that the questioned teachers teach, all of them are distributed between Elementary and High School**.**

Graph 1: Percentage of teachers who had soil content in their Undergraduate course

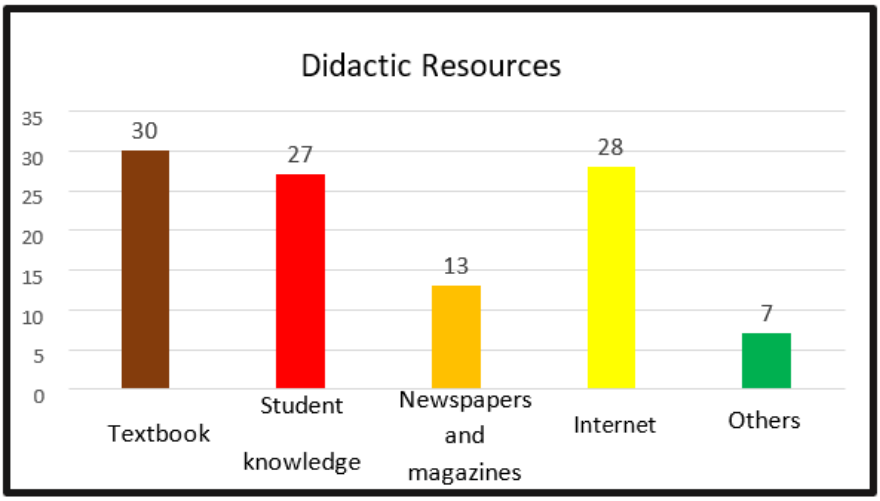


Source: Organized by the author-2021

Regarding which teaching resource is most used by the 30 teachers questioned, the schoolbook is pointed out by all (Graph 2). The schoolbook presents the relevant content for each grade. With simple information and some images, schoolbooks do not always present concepts or adequate explanations of the contents. Thus, it is the professional who must choose to use only the schoolbook or to look for other methodologies to ensure student learning, classroom interaction, and content exposure.

The methodology most used by teachers is the use of the Internet to take images and videos to work on the content (graph 3). In general, schools offer tools such as TVflashdrive and multimedia for teachers to use and present content in a more playful way.

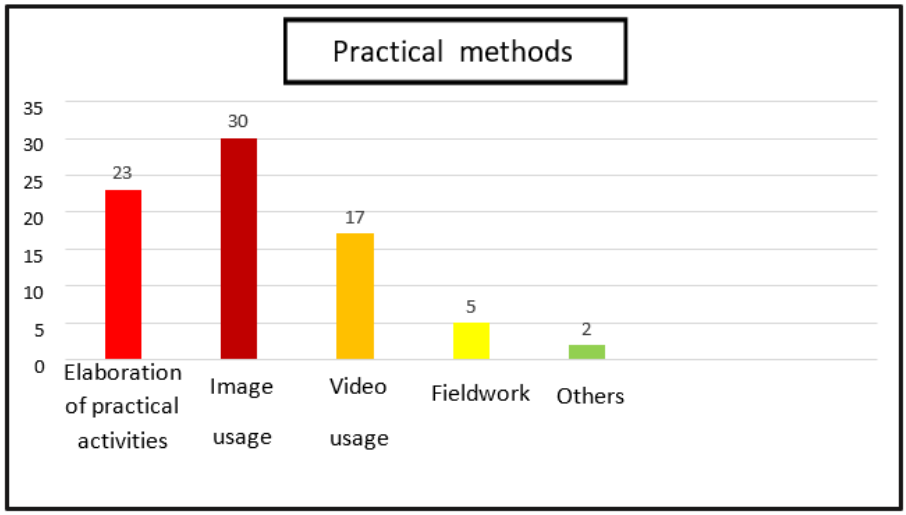
Graph 2: Teaching resources most used by teachers when working with the Soils content



Source: Organized by the author-2021

In practical methodologies, teachers report difficulty in developing fieldwork, as it demands more time than the class duration, besides the difficulty of transportation and the bureaucratic processes required to leave the school with the students (Graph 3). For these reasons, the fieldwork is not performed, and more practical activities are developed outside the classroom. These activities consist of making soil profiles, analyzing the different textures of the soils, and observing the characteristics of the soils inside the school space.

Graph 3: Practical methodologies used by teachers to work the Soils content.



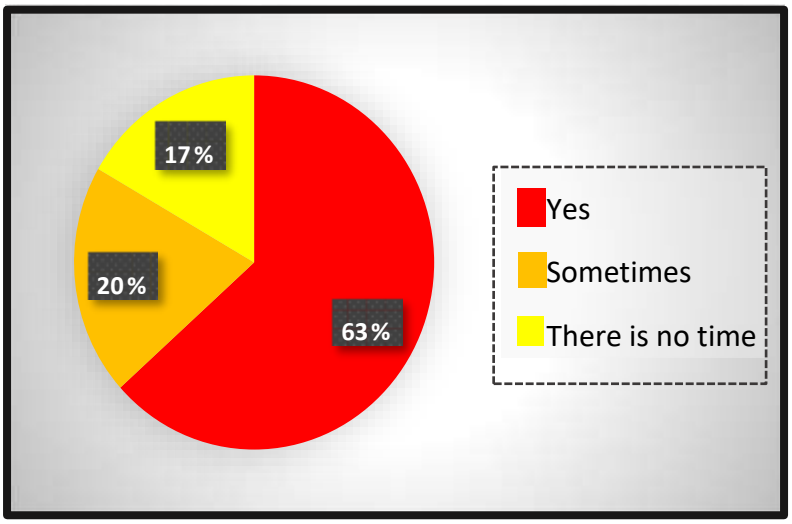
Source: Organized by the author-2021

Other activities: how to develop a soil profile with modeling clay for the early years of elementary school; practical analysis of the different types of soil; formation of a soil profile in pet bottles; models to represent soil formation and soil permeability are also options for working the content in a different and fun way.

More practical exercises are extremely important to collaborate in the understanding of the content for the student, as they allow the development of creativity, stimulating student-teacher interaction. With this, learning becomes more meaningful and, consequently, the student's satisfaction in wanting to learn increases. The development of these activities depends on the teacher and school support, since students are always open to new methods of escaping from the traditional classroom teaching (Freire, 2005).

Several teachers marked "no" as an answer to the question about the sufficiency of the approach to soil teaching content presented by the schoolbooks adopted by the schools. Thus, 19 teachers use other information about soils besides what the schoolbook presents (Graph 4). Other teachers say that lack of time and the amount of other content prevent them from searching for more information on this subject. And 6 questioned teachers indicate that sometimes they present other information about soil conservation.

Graph 4: Presentation of information about soils other than that found in the schoolbook

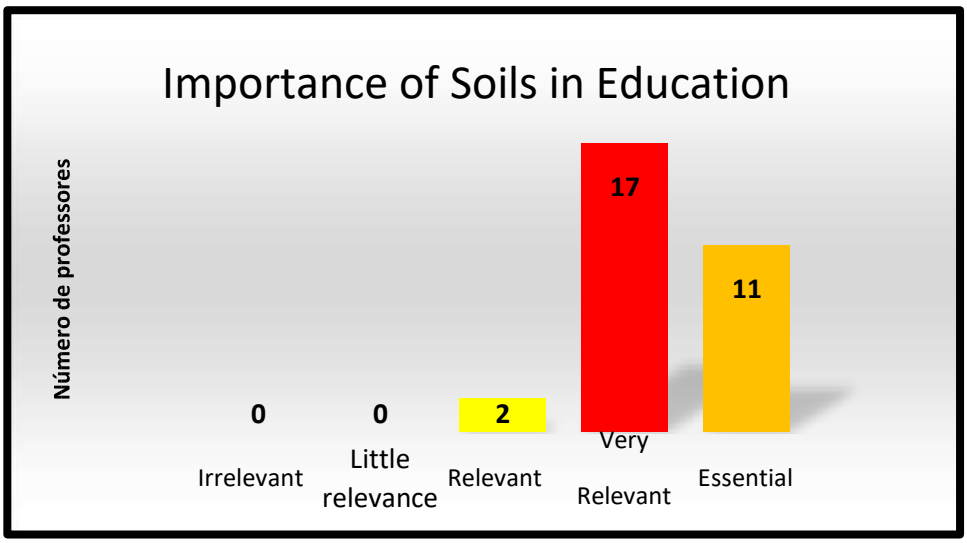


Source: Organized by the author-2021

The search for new teaching methodologies is still not very expressive, because the reality of many schools and the teachers' lack of time prevent didactic activities from being developed to attract more student attention (Freire, 2005).

All the interviewed teachers consider soil conservation important and the importance of working on this subject in the classroom. Therefore, regarding the relevance of the importance of soils in teaching, the teachers indicated as relevant, very relevant, and essential, justified by the fact that soil is a very important resource for the development of life forms on Planet Earth (Graph 5).

Graph 5: Relevance of soil content to teachers.



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Even though it is considered an essential natural resource, soil is a little debated subject in environmental discourses. Due to recent studies, little more than 60 years old, most of the society is not aware of the importance of this layer on the earth's crust. Thus, April 15th was declared as the National Soil Conservation Day, in accordance with the promulgation of Federal Law No. 7.876, of 11/13/1989.

Since then, several Brazilian institutions have developed projects called "Soils in Schools", with the objective of promoting education and popularization of knowledge about soil science, both for teachers and students. Presenting in a simple and didactic way the basic concepts about soil and the importance of this resource for biodiversity and the ecosystem (Lima, 2020).

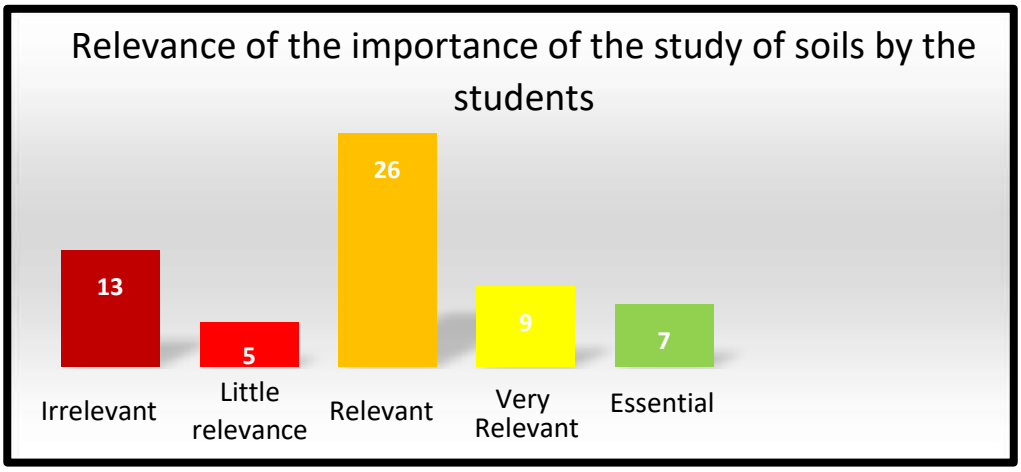
Authors such as Muggler et al. (2006) and Carvalho (2010) advocate the extension of university projects "Solos nas Escolas". This is already present in several universities, for example: University of São Paulo (USP), Federal University of Santa Maria (UFSM), Federal University of Mato Grosso (UFMT), Federal University of Campina Grande (UFCG), State University of Western Paraná - UNIOESTE (Marechal Candido Rondon campus), Federal University of Paraná (UFPR). Other institutions such as Embrapa, in partnership with UFSCar, USP, and the Brazilian Society for Soil Science (SBCS) have also created content for soil beneficial actions to help learning about soil conservation.

How students view the methodologies and didactic resources used in teaching

After applying the questionnaire with the teachers and analyzing the answers, we tried to find out how the 6th grade elementary school students and 1st grade high school students see the methodologies and didactic resources used by the teachers and the importance of soil as a natural resource. A total of 60 questionnaires were returned, with 9 questions to be answered.

Regarding the importance of soil-related content in their teaching learning process, most students (26) consider it relevant to study about soils. They justify this by stating that soil is necessary for food production and widely used in agriculture. Students who consider it irrelevant to study about soil, say that they do not observe it as a very important resource (Graph 6). Some students report that many times the content available in the schoolbook is explained by teachers in a quick way, especially in items related to soil formation. One of the interviewed 1st year high school students reports that: *"When the teacher explains without calling for our attention, the content does not get interesting and classmates do not pay attention, so the teacher does not talk much about the process of soil formation.*

Graph 6: Relevance of Soil Studies to students.

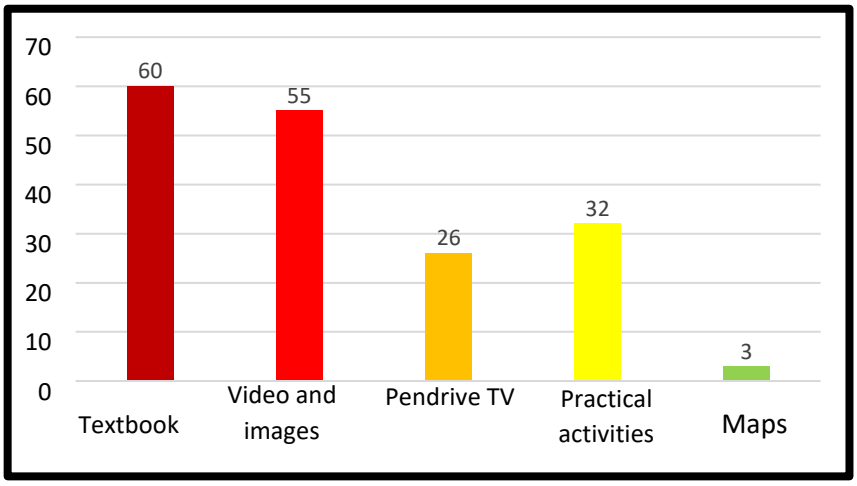


Source: Organized by the author-2021

In the question regarding which teaching resources teachers use to teach this theme, all students pointed to the schoolbook, followed by videos and images and some practical activities (Graph 7). These results are synchronous with the teachers' answers (Graph 2). For the students, the schoolbook is often the only way to approach the content, since it is a free material distributed by the schools.

Of the total number of students interviewed, 70% pointed out that the teachers use both theoretical and practical classes. The other 30% pointed out that they only have theoretical classes about soils. Subsequently, the students answered that videos and images, and practical activities are materials that help a lot to learn about the subject soils, with the help of the schoolbook to support the time of study.

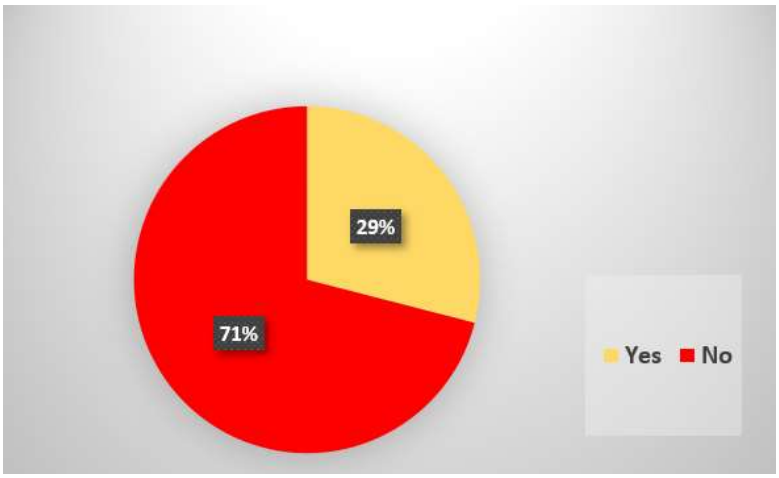
Graph 7: Teaching resources used by teachers, according to the students.



Source: Organized by the author-2021

About the importance of soil as a natural resource in the students' daily lives, 29% consider soil to be very important, whether for agriculture, plant development, and animal life (Graph 8). A 6th grade student justifies that: "The soil is very important, because in it we plant our food, and many animals need it to live." In the 1st year of High School, a student who has contact with agriculture reports that: "In the soil we find a bit of the past, like fossils. We need to take care of the soil so that we can produce food and income, without fertile soil we cannot produce, and many animals cannot develop.

Graph 8: Importance of Soils as a natural resource to students.



Source: Organized by the author-2021

The 71% of students who do not consider soil an important natural resource (Graph 8), they said that there are other ways to grow food, such as hydroponic crops. They also reported that they still cannot see soil as an important resource, compared to water. Analyzing Graph 8, it is possible to realize that students lack knowledge and information to help them understand the importance of soil, either by lack of relevance in schools, lack of teaching by parents and the little concern of the population for this resource, since children learn from adults and experiences with society.

CONCLUSIONS

We must consider that soil is a non-renewable natural resource, because its formation process is very slow, depending on several factors, including time. Its conservation is fundamental for the existence of biodiversity, whether by plants, animals, or human beings.

Based on the results obtained from the research, the theme Soils is not as emphasized and studied with the due importance it has as an integral element of the physical environment. Because it is a content considered irrelevant when it is produced in schoolbooks, there is a rupture in the teaching and learning process in schools, since the schoolbook is the most used material by Geography teachers in State schools in the town of Francisco Beltrão, Paraná.

Pointed as a content with few ways to work in practice, the traditional teaching, using more theory than practice, becomes tiresome for students, resulting in an unattractive content for the learning process. The use of images and videos highlighting the soil

formation process fails to emphasize what should be interesting, that is, soil conservation and its importance. These are studied and presented to the students briefly, without considering the functions of soil for biodiversity.

Teachers agree that the study of soils in schools is very important, but the lack of resources and, especially, of time becomes a barrier for teaching. As they are used to using schoolbooks, searching for new methodologies of practical activities that interact with the student and make this learning process more relevant is a double task, which is not in the traditional way of teaching.

For the students, since there is a rupture in the system, soil is noticed as just a material we walk through. They understand the whole process and the factors of soil formation, but do not know ways of conservation and cannot indicate the functions and importance of this resource.

We know that children and teenagers will be the ones responsible for the environmental educational changes. These issues need to be emphasized more in schoolbooks, since it is a material made available by the government to all public schools in the country and the resource most used by teachers. Improvements in the teaching system should also be considered, since teachers do not have the necessary time to develop and prepare classes, continuing with theoretical and traditional classes.

Thus, it can be concluded that the study on soil teaching in schools should be more emphasized. Projects that help in the teaching and learning of students should be adopted by schools so that a continuous awareness building about this subject can occur. The content of soils should have a greater notation and cover more space in books and classes, it needs to be studied more depth and be close to the students in activities such as field work. In the teacher education process, it is important that Pedology is included in the curricula of undergraduate courses in Geography. This allows for a stronger foundation about soils, collaborating with the professional training as a future teacher.

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