



## **PEDAGOGICAL PRACTICES IN SCHOOL GUIDE**

### **Physiographic Survey of the Cafuá Stream and the Construction of Pedagogical Practices at School**

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## INTRODUCTION

This Guide is the final product of the master's dissertation: **Physiographic Survey of the Cafuá Stream and the Construction of Pedagogical Practices at School** to the Professional Master's Program in Teaching in Health and Environmental Sciences at the University Center of Volta Redonda - UNIFOA.

The objective of the work was to develop scientific research on a topic so expensive to the population of densely urban centers: the water bodies environmental pollution and to indicate the pedagogical practices for the environmental education development projects by teachers and students, preferably in educational establishments of the studied region, as well as suggests a pedagogical dynamic so that, in part, the Physiographic Survey is replicated.

It presents suggestions of pedagogical dynamics, Conversations Circles, for the conception and planning of the activity by the teachers and students, in which the concepts and experiences of the students are considered, according to David Ausubel's theory for meaningful learning, with its subsumption concepts, videlicet, the relevant pre-existing concepts of the significant structure that the learner brings.

Finally, it contains suggestions for pedagogical practices: Parodies Elaboration, Free Design and Theater Sketch that help in the effective goal of the teaching-learning process where the student is an active part in the process of obtaining and building knowledge, enabling and training him as conscious citizen and able to disseminate what was learned and perceived in the Family and by extension in the Community.

Also, The Guide summarizes the theoretical research carried out, the field practice of the Physiographic Survey of the Cafuá stream sub-basin and the results of the anthropic impacts caused to the water body.

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## STUDY AREA: VOLTA REDONDA

The study area is located within the Brazilian Megalopolis in an area of 82,616 km<sup>2</sup>, 0.97% of the national territory, with 41.7 million inhabitants, 22.66% of the Brazilian population (2007) and gross domestic product (GDP) in 2004 of 420 billion Reais, 35% of the Brazilian GDP (IBGE, 2015).

It is located in the southern portion of the state of Rio de Janeiro, in the municipality of Volta Redonda and in the lower stretch of the Médio Vale do Paraíba do Sul, between the Serras do Mar and the Mantiqueira. Located at 22°31'23" S and 44°06'15" W and at an altitude of 390.0 m, the city to the south, southeast, and east with Piraí; to the southwest with Barra Mansa and Rio Claro; and the northeast with Barra do Piraí and Piraí. Volta Redonda, with an area of 182.8 km<sup>2</sup>, is one of the smallest municipalities in Rio de Janeiro (IBGE, 2015). Figures 1 and 2.

Figure 1: National Megalopolis Volta Redonda.



Source: "Megalópole" in *Geografia*. Virtuoso Information Tecnology, 2007-2019.

Figure - Location of the municipality of Volta Redonda in the state of RJ.

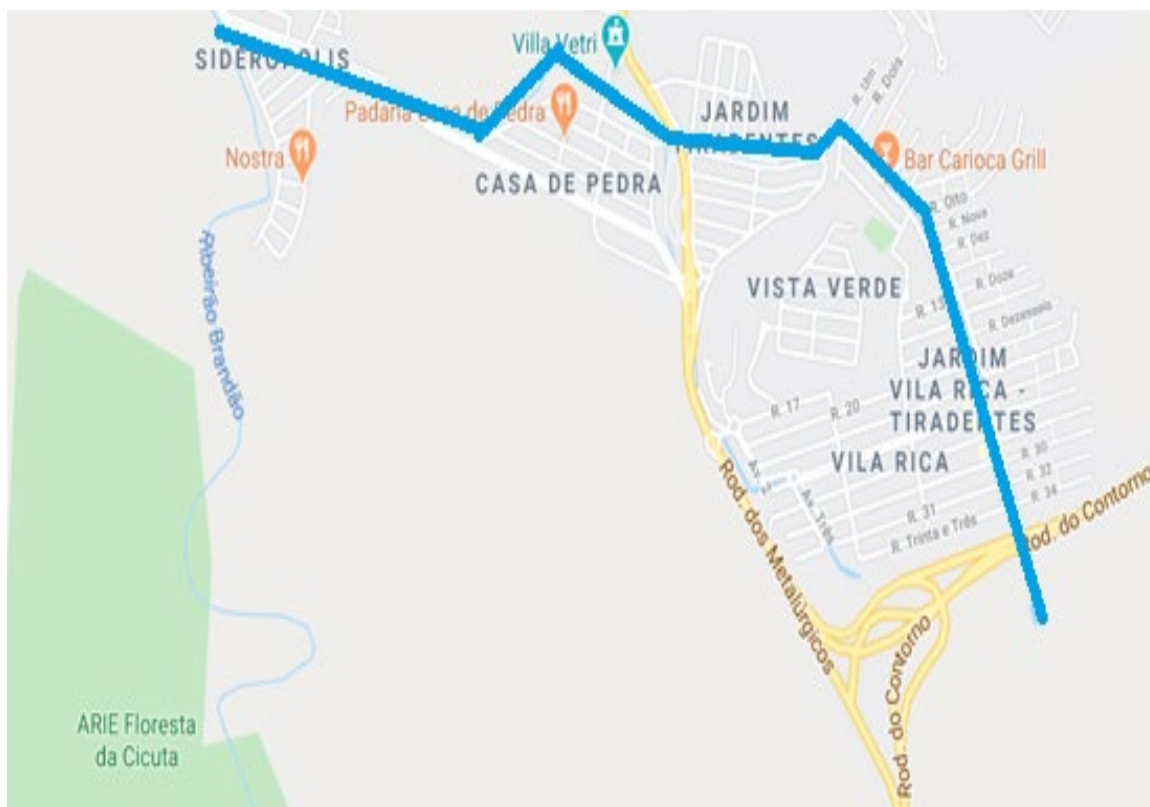


Source: "Megalópole" em *Só Geografia*. Virtuuous Tecnologia da Informação, 2007-2019.

### STUDY AREA IN THE MUNICIPALITY: CAFUÁ STREAM

The research carried out has as its object the Cafuá stream, a sub-tributary of the Paraíba do Sul river that cuts through the neighborhoods of Vila Rica, Jardim Tiradentes-Vila Rica, Vista Verde, Jardim Tiradentes, Casa de Pedra and Siderópolis in the municipality of Volta Round (Figures 3 and 5).

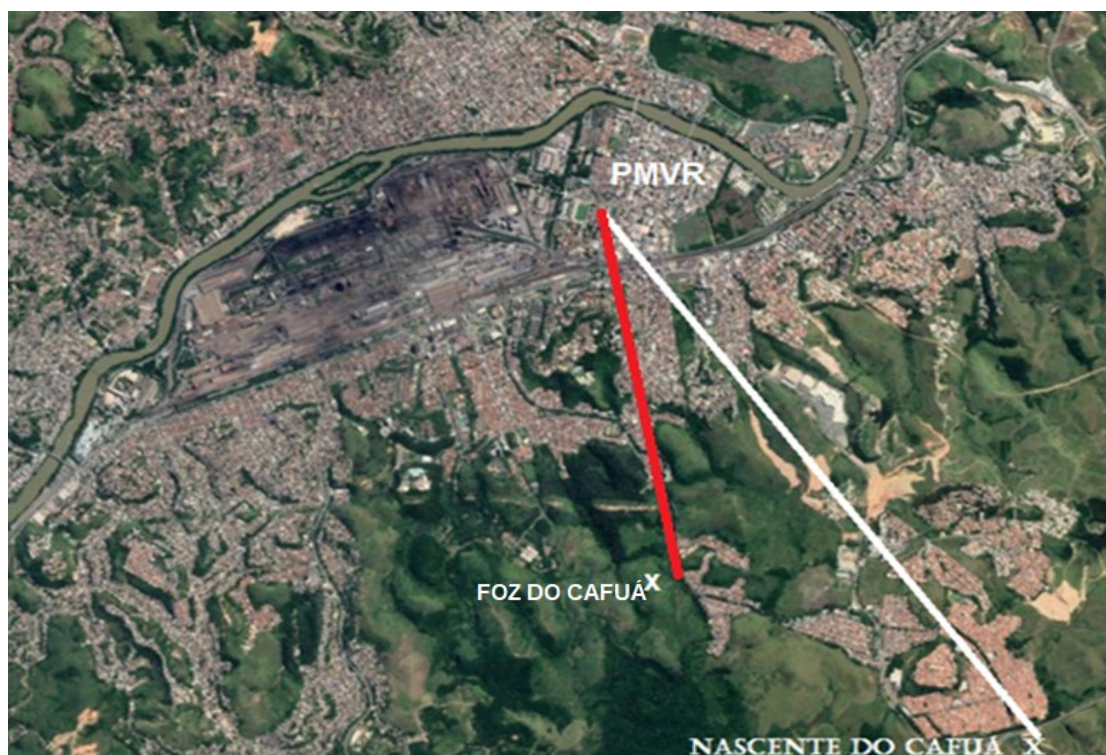
Figure 3. Mapa de área cortada pelo córrego Cafuá.



Source: the author (2020) on Google Maps (2020).

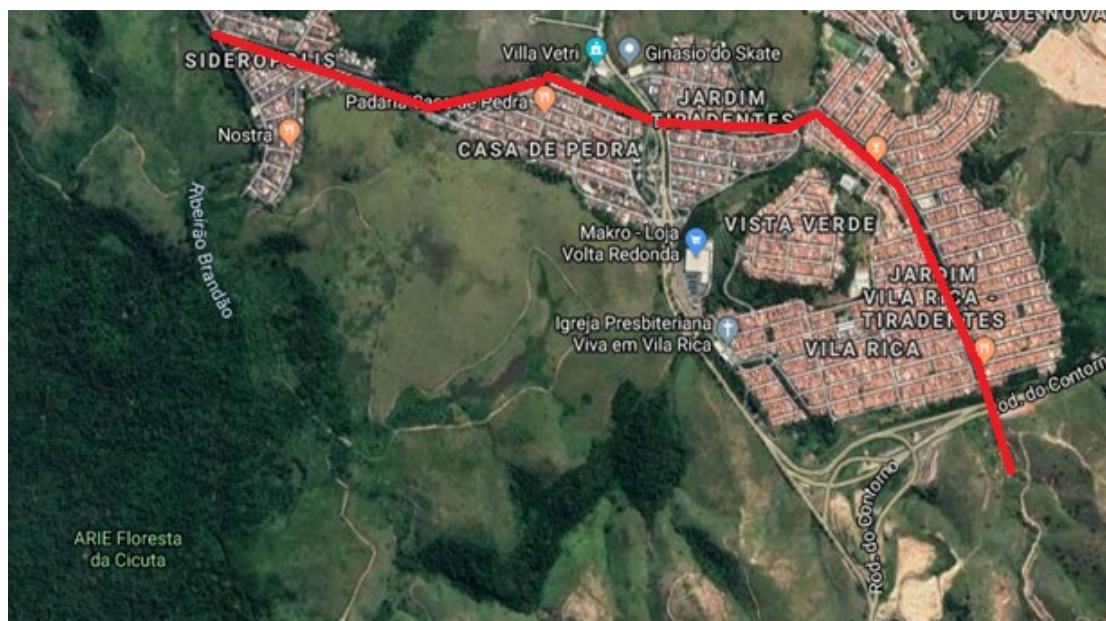
Forming a sub-basin of Ribeirão Brandão, a tributary of the right bank of the Paraíba do Sul river, Cafuá has an area of 0.8 km<sup>2</sup> (river bed plus the margin of the exceptional largest bed). It has a slope of 0,0142 m per meter and is 2,630 meters long, from the source in the Vila Rica district to its waters at the Brandão stream, in the Siderópolis district. In situation, its source is located at 4,884 meters from the seat of the municipality, the Volta Redonda City Hall (PMVR) in the Aterrado neighborhood and its river mouth at 2,786 meters (Figure 4).

Figure 4. Situação do Córrego Cafuá em relação à PMVR.



Source: The author on Google Earth. (2020).

Figure5. Imagem de satélite do Córrego Cafuá e bairros.



Source: The author on Google Earth. (2020).

## TECHNOLOGICAL TOOLS

In the preparation of the basic physiographic survey activity script to be carried out by teachers and students, in the analysis, interpretations and discussions on the environmental problems detected and in the preparation of a final report, it is recommended the use of technological tools like Internet research, cell phones for video recording and photos taking, and software for image processing and slide making.

Likewise, if there is no software already used and its use dominated by teachers and students, I recommend the same suite of software for support, development and image editing work used in the preparation of this research work, that is: Microsoft Paint, LC Media Player, Google Earth, and Google Maps.

The **Microsoft Paint** was a software used for creating simple drawings and also for editing images. The program is included, as an accessory, in Microsoft's Windows operating system and in its early versions it was known as Paintbrush.

The **LC Media Player** is a free media player available for different platforms. The program's main attraction is a basic interface aimed at lay users. The software has several features to suit even the most demanding people, like audio and video effects.

The **Google Earth** is a computer program developed and distributed by Google whose function is to present two-dimensional and three-dimensional models of the planet. It was built from a mosaic of satellite images obtained from different sources, aerial images (photographed from aircraft) and 3D Geographic Information System (GIS). It can generate two-dimensional maps and satellite images or as a simulator of the different landscapes present on the Planet Earth. Thus, it is possible to identify places, buildings, cities, landscapes, among other elements.

The **Google Maps** is similar to Google Earth, however, less complex. It assists in the research and visualization service of maps and satellite images of the Earth. The service provides maps and routes and satellite images from around the world, with the possibility of zooming. The Google Earth and the Google Maps were produced by Google LLC, a United States multinational company for online services and software.

The aforementioned softwares are freely accessible and with a friendly interface, becoming at the same time powerful instruments for the expansion and production of knowledge in a pleasant and motivating way, since it makes it possible, with general Information and Communications Technology (ICTs) in general, to bring the concreteness of areas only imagined by the apprentices how to show in a systematic way the reality of the landscape that surrounds them, which is part of their subsumptive concepts.

For the tables and graphs preparation, reports and slide presentations, the Excel, Power Point, and Word use is recommended. All from the Microsoft Office Suite.



### **PREPARATORY ACTIVITY – CONVERSATION CIRCLES**

The Preparatory Activity Conversation Circle is indicated to be carried out by teachers and students when planning the project as one of the school activities of the two months period. It should be mediated by the teacher in conversation with the students.

At the beginning of the activity, the knowledge level, understanding, and student's awareness about human anthropic actions caused by man in the environment, their effects and possible mitigating actions, as well as the information they have around their school regarding the Cafuá stream.

At the same time, the teacher will present information that allows students to be evaluated through proposed oral arguments. Then the teacher will prepare a small diagnostic report, the basis for adjustments, and gradation of the depth level on the proposed action plan.

This Conversation Circle with students about the contents associated with environmental education and that being part of different contents in different subjects will result, in a final oral presentation in a conclusions list reached by its members and summarizing the practical and theoretical activities to be developed.

The general scope of the project should be prepared with a brief introduction, goals, description of the steps to be taken to build the practice, the materials list, resources, and inputs to be used and a schedule.

After the final oral presentation, the conclusions reached by the students will be listed and summarized in a digital report written and illustrated with figures and photographs.

<b>WHAT?</b>	<b>CONVERSATION CIRCLES</b>
<b>WHO?</b>	Teacher and students.
<b>WHERE?</b>	In the Classroom.
<b>WHY?</b>	In order to carry out a diagnostic activity on the knowledge and experiences already brought by the students, including some content and themes for reflection and collect data for possible adjustments to the proposed pedagogical practice.
<b>WHEN?</b>	At the beginning of the two-months term.
<b>HOW?</b>	Through dialogued activity in conversation.

### **BASIC ACTIVITY**

The basic activity planned in the Conversation Circle consists of conducting a field practice, with students on the banks of the Cafuá stream near the school to verify the results presented, to experience the practical experience of the work author and make new observations and reports that have not been considered by the author for not living in the community and not having the teachers and students experiences.

In your planning, you should use the three learning modes proposed by Ausubel: representational, conceptual, and propositional.

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The representational where, through observation and the theoretical preparatory knowledge learned, will assign meanings and certain symbols relating objects, events, and concepts, where the symbols now have significance and are covered with the meaning of their referents.

The concepts learning where one seeks to observe the regularity of the events and objects seen. The aim is not only to learn the meaning of the concepts, although it is a condition *sine qua non* for learning, but also to understand the ideas meaning spoken orally.

The challenge is to build learning that is beyond words and the absorption of the proposed concepts. For a better understanding of the processes that lead to the absorption and organization of new meanings in the formation of a knowledge base, a way of propositional learning, an "assimilation theory", a friendly way to retain knowledge, and its conditions.

The visa observations and inferred in the field practice must be noted and described in field notebooks and must be illustrated with images of videos, photographs, sketches and possibly small semi-structured interviews with the local population.

The data and observations activities and the field practice data collection should be analyzed and interpreted, with the organization of the new knowledge generated with those already brought by the students in different categories and forms of expression, helping in the understanding and comprehension of the investigated context.

<b>WHAT?</b>	<b>PRÁTICA DE CAMPO</b>
<b>WHO?</b>	Teacher and students. Assistance from teachers and/or school agents for support.
<b>WHERE?</b>	In the field on the banks of the Cafuá stream in a stretch close to the School.
<b>WHY?</b>	Through the action of replicating part of the activity of physiographic survey carried out by the author, so that students can better know and understand the environmental impacts generated by the anthropic action of their community in the Cafuá stream.
<b>WHEN?</b>	During the two-months term.
<b>HOW?</b>	Using research in the didactic material made available by the school and on the Internet; field book; cellular device for recording images in videos and photographs; using software for making available and processing images and producing a written and illustrated field report.

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<b>WHEN?</b>	During the two-months term.
<b>HOW?</b>	Using research in the didactic material made available by the school and on the Internet; field book; cellular device for recording images in videos and photographs; using software for making available and processing images and producing a written and illustrated field report.

### **PEDAGOGICAL PRACTICE PROPOSALS**

At this stage, it is recommended that they have a positive impact on the students involved and be conducted in a climate of joy and relaxation. They should also have the power to arouse the student's curiosity and interest and be tools for the improvement of the learning process, helping to overcome the obstacle that many students generally do not face when learning when faced with a traditional form of teaching.

It is necessary that the activities developed by the teacher within the classroom are not restricted to theoretical aspects or to some practical activities. It is essential that practical activities provide the student with a space for reflection, development and construction of new ideas.

The teachers should appropriate technical and pedagogical resources, and why not technological, for the students' learning. The students in general enjoy the initiative of the teachers, in delegating to them the co-participation in the teaching proposal and the elaboration of the activity.

The three suggested practices are intended to exemplify part of the innumerable possibilities of practices that may derive from the environmental survey work carried out, including those demanded by meetings between the neighborhood community, the school community, teachers, and guided mainly by the students' sub-concepts.

The author does not wish to exhaust the topic, on the contrary, his intention is to contribute with significant and relevant practices and actions that will not only contribute to a more effective students learning but also instigate the emergence of many other practices. Thus, there will be a demand from the community segments of the neighborhoods, the school community, and teachers in which everyone knows and primarily considers, as a

basic condition for effective education, the relevant pre-existing concepts of the significant structure of the student.

The activities proposed as an example, presented in detail, are: Parody Elaboration, Free Design and Theater Sketch.

### **ACTIVITY PROPOSED AS EXAMPLE: PARODY PREPARATION**

A parody is a change in the lyrics of a known melody with content on the subject studied.

Parodies may be used as a tool to raise awareness of water in environmental education. Parodies are alternative methodologies that may be used by teachers in the classroom. According to Cabrera (2006), the use of alternative methodologies, motivating learning, and playful activities are auxiliary means that arouse the students' interest, and may be applied at all education levels.

The ludic brings emotion to the classroom, a feeling that favors the formation of long-term memories, the type of memory necessary for meaningful learning. Parodies may be other ways of working with content at school. In this sense Melo and Assis (2013) comment that the practice of associating the learning of subjects with music has always been widely used and is a positive factor for learning, being able to awaken and develop in students more acute sensibilities in the observation of their own questions to the target discipline, in addition to improving the quality of teaching and learning, as it stimulates and motivates teachers and students.

Ático Chassot (1995) emphasizes that the reorganization and critical renewal of the content itself, deviate from the descriptive content, in order to create an awareness with social and political responsibilities. Hence, much of what is currently taught is useless for most students. In addition to a reorganization of the content itself, the diversification of teaching resources is an attempt to overcome the lack of interest in Chemistry in high school, showing that this discipline goes far beyond calculations, memorizing formulas, and nomenclatures. A promising alternative, but also little practiced, is the music use in science education.

The music may be a fun activity. Ludic activities trigger thought and memory, generate opportunities for the expansion of emotions, as well as pleasure and creativity feelings, since the seriousness conditions, commitment and responsibility, instead of being lost, are felt. Thus, as pleasurable activities for the organism, ludic activities would facilitate learning, as the mechanisms for the discovery processes are intensified Santana (2008).

In developing the practice, it is essential to maintain an atmosphere of joy and playfulness in the class. Without humor, the educator does not experience the existential encounter with the student and blocks the teaching-learning process itself. The traditional education placed the virtues: attention, dedication, and responsibility as incompatible with joy and relaxation (CARDOSO 1995).

The music, therefore, may be a motivating and facilitating element in the teaching process of learning scientific concepts, also due to its ludic character. Ludic activities in the classroom may arouse the students' interest in the search for solutions and alternatives that solve and explain the proposed theme (OLIVEIRA; SOARES, 2005).

### **Activity Stages**

It is recommended to divide the class into four students groups, between seven to fifteen participants organized voluntarily; introductory conversation on the topic, talking about the water source, the processes it goes through to become potable and its conservation, tangent with multidisciplinary (health, geography, environment); lecture on the water importance for the planet: The presentation will take place through a play performed with puppets, parodies challenge, and groups of students who will present their parodies on the exposed theme (You, Water and the World) elaborated by all school students who are participating in the event.

<b>WHAT?</b>	<b>PARODY</b>
<b>WHO?</b>	Teacher and students. Assistance of art and Portuguese teacher.
<b>WHERE?</b>	In the Classroom and at Home.
<b>WHY?</b>	For, using a musical expression to present content, ideas and perceptions of the studied theme.
<b>WHEN?</b>	During the two-months term.
<b>HOW?</b>	By changing the lyrics of a well-known melody with content on the subject studied: Cafuá stream environmental degradation.

### **ACTIVITY PROPOSED AS AN EXAMPLE: FREE DRAW**

The Free Draw production technique, the Free Draw production associated with environmental education and the activities carried out until then is recommended to be developed individually by the students.



Drawing is a mental configuration preliminary process in search of a solution, it is a graphically represented vision of a future work. It is a representation form that the student finds in an attempt to organize and reorganize his environment, as drawing enables the construction and reconstruction of what is around him. The drawing is characterized by the graphical representation of lines. The trace use, in an isolated way or in the construction of forms generating figurative or abstract images (MARTINS; GARCIA, 2014).

Drawing consists of expressing thought and the drawing act can be considered a creation act, innovation or modification of something that already existed through abstraction, synthesis, ordering or transformation (MARTINS; GARCIA, 2014). According to Derdyck (1989), "There is no longer any doubt that all people are innately creative, regardless of their cultural background, racial or geographical origin".

The drawing act is a joint action between intelligence, emotion, sensitivity, and decision-making power. In childhood, children unconsciously scratch and scribble everywhere and any object becomes material for their doodles. With that, they explore spaces, perceive the world, and perceive themselves in it. Later, after the age of 10, the children draw what they know and not what they see. When drawing an object from observation, it becomes very different from the object to be represented, as this observation transforms the look at the world (MARTINS; GARCIA, 2014).

Initially, to see, you have to want to. It is, therefore, a deliberate vision, which has drawing as an end and means, simultaneously. When drawing, voluntary attention is necessary, capable of transforming what was believed to be known. In this sense, it is not a reality copy, but the appreciation of the unique expression of each student (MARTINS and GARCIA, 2014).

### **Activity Stages**

Initially, it is suggested to develop the basic drawing techniques within the discipline of Arts through practical classes, giving the opportunity to participate in experiences that used different resources, and materials, aiming at the education of the gaze, through meaningful practices, developing the seeing, understanding, and creating and stimulating the student's creative and aesthetic potential. The classes should also provide opportunities for interaction with varied practices, diverse resources, materials, and innovative supports, in research and learning in art, collaborating to form a critical and well-founded view of drawing production.

It is necessary to use in these classes various materials and drawing supports like cardboard, craft paper, cardboard, craft paper, charcoal, crayons, pencils, pens, and colored pencils, hydrographic pens, and gouache.

With the Science or Geography teacher mediation, so that, in fact, the drawing construction takes place in a reasoned way, it is important that the teacher provides various information and promotes activities that exercise the perception, and knowledge about the drawing production. In this case, the Environmental Education and Environmental Impacts theme have as object the surroundings of the Cafuá stream.

A dialogue should also be proposed to enable reflection on the design. After the dialogue, the students should be urged to build a narrative, making their considerations on the topic.

Afterwards, it is time to make a drawings exhibition where each student presents his drawing giving its significance.

Finally, the teacher should comment with the students that they were led to observe the nature of the environment and the degrading actions results in the school environment, paying attention to the figures details, their colors, shapes, textures, and an action figurative representation. From that observation, they realized details that would make other forms possible, and then created, from these details, drawings of non-figurative representation. After this dialogue, it should be concluded that each one used their sub-concept concepts for the drawing's construction.

<b>WHAT?</b>	<b>FREE DRAW</b>
<b>WHO?</b>	Teacher and students.
<b>WHERE?</b>	In the Classroom.
<b>WHY?</b>	For, through the fine arts language, they present a synthesis of what is observed, understood, and inferred.
<b>WHEN?</b>	During the two-months term.
<b>HOW?</b>	Through the free draw production associated with environmental education and the activities carried out until then. Individually by the students. Activity whose object is the environmental degradation of the Cafuá stream.

#### **ACTIVITY PROPOSED AS AN EXAMPLE: PREPARATION OF THEATER SKETCH**

The basic methodological approach carried out for the theater teaching in basic education practiced within the Arts discipline and its pedagogical and conceptual implications allows to bring theatrical language closer to the spaces of basic education schools (SALLES; SITTA, 2018).

According to Cavassin (2008), the theater presence importance at all levels of the educational process is capable of enabling an integrative educational experience including the learning of the art/life relationship. Actions are needed to strengthen the area as knowledge and to realize the cognitive, social, and psychological contributions that the theater has to offer. The possibility of theater at school helps in the knowledge acquisition and in overcoming limits, but also in the possibility of pleasure in the creation act that it can bring.

The theater, due to its playful nature, allows the expressiveness, the integration, the communication, and the joy that can come from all these activities. The education through art aims to stimulate creative behavior, developing artistic and critical sense, in the expression and communication art form of a language inherent to man (SALLES; SITTA, 2018). However, in order to achieve these objectives, there must be encouragement by teachers and the Ausubel subsunctorial method use is essential, where the individual's prior knowledge, the relevant pre-existing concepts of the significant structure of the learner are considered relevant, and learning becomes more effective and meaningful, in an environment of greater comfort for the apprentice as the new information dialogues with these subsumption concepts.

The theatrical language use, in any discipline or education level in the school community and in the local community, helps the student full education through the search for dialogue, ethics, freedom, and individual and social transformation (SALLES; SITTA, 2018).

Through ludic theatrical games the child expresses his emotional needs, in a catharsis provided by the drama in which he is involved. "The game is really life. The best children's play can only take place where opportunity and encouragement are consciously offered by an adult mind. This is a "nutrition" process and is not the same as interference "(SLADE, 1978). In this sense, the pedagogical intermediation to be carried out by the teachers becomes essential.

Boal (1998) sees theater as a tool for social change, a theater that is politically engaged. He proposes a theater that serves to discuss in a critical and participatory way the oppressions experienced in daily life, thus showing the side of the coin that hegemonically

faces downwards. The theater can generate views between students and students for these oppression situations experienced in everyday life, giving a voice to the oppressed (SALLES; SITTA, 2018).

The theater may generate discoveries. "The theater is born when the human being discovers that he can observe himself: see himself in action. He discovers that he can see himself in the act of seeing himself - seeing himself in a situation" (BOAL, 2000).

Brecht (2005) evokes the theater use of critical positioning, reflection, and analysis by the spectators, who at school are the other students, the family, and the community. The Epic Theater political stance and its Didactic Pieces shows the performance that dialogues with a transforming action. From the strangeness/distance the viewer critical spirit arises, capable of analyzing and criticizing the social life.

### **Activity Stages**

Develop within the Arts discipline the basic methodological approach carried out for the theater teaching in basic education with the practices that allow the theatrical language approximation with the various themes treated in the different disciplines.

Then it is suggested to work on basic theater techniques through practical classes, giving the opportunity to participate in experiences that experience different situations and contextualization, including in time and space, aiming to develop sensitivity through meaningful practices, developing the view, the perceive and the create, thus stimulating the student's creative and aesthetic potential.

Then, with the professor of Arts, Portuguese, Sciences or Geography mediation, so that, really, the dialogues construction takes place based on theoretical and practical information about Environmental Education and Environmental Impacts made available by the research developed by the author.

A dialogue should now be proposed to enable reflection on the text produced and students should be urged to build a final narrative and with the teacher intermediation, the staging of the sketch produced should be created, stimulating the creative process and students talent in scenarios terms, costumes, music, special effects, and other activities inherent to the theatrical sketch realization.

Finally, there will be a presentation for the school community and then for the regional community in the neighborhood.

<b>WHAT?</b>	<b>THEATER SKETCH</b>
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<b>WHO?</b>	Portuguese, Arts, Sciences and Geography teacher and students.
<b>WHERE?</b>	In the Classroom, at School and at Home.
<b>WHY?</b>	Through the performing arts use, express the environmental, economic, social, and cultural situation perceived during the activities carried out.
<b>WHEN?</b>	During the two-months term.
<b>HOW?</b>	Producing two theater sketches, each for half a class, where the environmental situation found is represented, the consequences of these problems are summarized and possible mitigating solutions are proposed. The theme is the environmental degradation of the Cafuá stream.

### **SUMMARY OF THE PHYSIOGRAPHIC SURVEY CARRIED OUT**

The survey made it possible to obtain data and to infer them with theoretical and practical knowledge that allows to indicate varied conditions and situations both in the survey of the natural and anthropic physiographic landscape.

In the entire route taken by the Cafuá stream, no rock outcrops nor the rocks presence were directly observed. As it is a low valley are and the land intense remobilization due to the construction of the urban site, this was expected. For the same reason, there are no soils in-situ, being found only soils remobilized by human action during the urbanization process and/or by the rain action and river waters (Figure 6).

Figure 6. Alignments arise from the geological inferences of the Cafuá stream.



Source: the author (2020).

For the same reason, no deformation structures were found in rocks, but the general alignment of the watercourse direction in less urbanized stretches, even knowing the corrections suffered, allows to identify the structural directions of regional geology: West-Northwest/East-Southeast or East-Northeast/West-Southwest, as suggested by the possible alignment shown in figure 7.

Figure 7. Alignments arise from the geological inferences of the Cafuá stream.



Source: the author (2020).

However, by the mineralogy found in sediments, quartz, feldspars, and micas, it is possible to recognize the type rock of the region: the gneiss.

The geomorphology, the landforms that surround the Cafuá stream valley are the half-oranges and hills typical of the South Fluminense region, and in the low areas there are river terraces now observable on the ramps that border the Cafuá course.

These terraces are now larger (Figures 8 and 9), when the margin widens, as occurs in section 1. Erosion is the type caused by rain and/or river runoff.

Figure 8. Hills and terraces of the Cafuá stream



Source: the author (2020).

Figure 9: hills and half oranges in the region.



Source: the author (2020).

The native vegetation, Atlantic Forest, only does not exist within the stream valley, being observable at the river mouth towards the Cicuta Reservation. The typical secondary vegetation in the region, the macega, may be observed in the spring area and in the elevations surrounding the route. The plant species used to plant the boulevards are typical of the Atlantic forest and the colonization grass that dominates a large part of the bed, especially in Stretches 1 and 2, is not native of Brazil, although it is common. It was introduced during the period of livestock activity in the Rio de Janeiro region.

The soils in the region of the stream basin are allochthonous, alluvial soils, resulting from the decomposition of the gneissic rocks surrounding these soils. The soil on the river bank is alluvial soils. They are stratified in layers and are of recent age and little evolved. The origin of these alluvial soils occurs due to the carrying caused by the waters of the Podzolic soils coming from the slopes of the region. These soils are light in color at the top due to the dissolution of iron, clays and organic matter and deeply reddish to yellow in color due to iron oxides (Figure 10). Another regional soil is the Oxisol, mineral soils with red and yellow tones.

Figure 10: alluvial soils





Source: the author (2020).

The drainage pattern is not clear due to the intense correction suffered by the course during the process of neighborhoods occupation and urbanization. However, due to the indirect observation of the geological structure of the region, the typical dendritic pattern of the region is inferred.

The stream does not have a tributary; however, several drainages are observed through which water flows when the rains are tributaries of the Cafuá stream.

The river channel is in general regular corrected by engineering works that occurred in a large part of it has a very homogeneous width, being approximately 6.0 meters wide of the largest channel. The smaller channel, corrected or not, varies from 1.0 meter to about 5.0 meters. The gutter height, the largest channel, is about 6.0 meters and that of the smallest bed is less than 40 centimeters during the regular period without rain. From the observed evidence, erosion of the terrace ramp, pipe presence that cuts the channel, debris deposit and dismantling of engineering works and position of the tree and shrub vegetation, the height reaches about 5.0 meters, with no evidence being observed floods that spilled water out of the larger bed (Figures 11 and 12).

Figure 11. Trough of the Cafuá stream.



Source: the author (2020).

Figure 12. Trough of the Cafuá stream.



Source: the author (2020).

The physiographic survey realization that can be carried out by teachers and students of the surrounding educational establishments, because they know the place, may bring valuable information about the eventual floods, their frequency and consequences.

The source's altitude is 439.0 meters and at its river mouth 392 meters, a variation of 47.0 meters. In 2,700 meters of travel the total slope is 0.8 degrees, therefore, this gradient is very low. Note that the slope per meter is 0.017, very close to that found in the literature, which is 0.014 m per meter (Rodrigues, 2008).

Its speed is low, varying according to the local irregularities from less than 0.5 m/s to 2.0 m/s.

No animals were found during the survey, but it is assumed that the stream is occupied by mice and insects that are typical of this environment.

The final survey took place in the months of April and May 2020, where, according to the climate data, there is a variation in the city of rains from 38.0 mm (March) to 28.0 mm (May), which represents an average daily rainfall of 1.23 mm (March) to 0.93 mm (April), average of 1.0 mm (that is, an average rainfall of one liter per square meter of area), too low to eventually cause significant floods.

The terraces dismantling occurs due to the erosion caused by the domestic sewage discharge *in natura*, by final rainwater dumping that is drained into the river, by the tree roots erosion and shrubby plants that were planted in the stream framing the stream and by the dismantling of engineering works, especially of the concrete ramps and walls that surround the bed smaller (Figure 13).

Figure 13. Sewage discharge in natura and erosion



Source: the author (2020).

There are no recent landfills signs, although it is clear that it happened in the past due to actions to correct the river course, and there are no invasion areas with the stream's grounding, artificial water drainage and pits from sand exploration.

The neighborhoods expansion with the residences construction and urban equipment waterproofed the territory, eliminating large areas that acted with natural reservoirs to dampen flows, reducing runoff;

The increase in flood flows is incompatible with the pipe's dimensions implemented in these basins' courses, which are practically unchanged in the presence of the already consolidated urbanization.

The stretches silting of the courses due to deforestation and erosion of the slopes, and the destabilization and erosion of the margins, intensified solid transport (figure 14).

Figure 14: Silting of the Cafuá stream.



Source: the author (2020).

The dumping of urban waste, domestic sewage, and construction rubble directly into the gutters, contributing to accelerate the silting process.

It is possible to observe in some crossing stretches, the channel section channel narrowing and the pipes presence that crossed the sections at half height, implicated in obstacles that prevent free flow.

The correction and containment actions in the sub-basin of the Cafuá stream carried out through engineering works like the concrete walls and/or sand sacks construction, concrete ramps making, wall fences of the lower channel, concreting the river bottom, the harmonization of the channel aligning the course in a straight line, the cultivation of trees and shrubs on the largest bank of the river framing similarly to a riparian forest were shown to be vigorous and correct attitudes that certainly minimized the impacts of the floods of the stream.

The maintenance lack of the aforementioned engineering works, their degradation compromises the expected results and end up contributing to gradually worsen the effects of the floods that it was intended to overcome.

The foresight lack in the actions planning like the ramp's geometry and the stream layout, the choice of planted plant types contributed to increase the degradation of the interventions carried out thus increasing the need for maintenance.

Throughout the Stream Cafuá route, 12 steel water or sewage tubes were recorded crossing the stream channel at an average height of 2.5 to 3.0 meters, which help to retain the load when there are heavy rains and that result in friction points that hinder the flow of water; 18 sewage tax points, by which there is eutrophication and pollution of the water body and 23 points of rainwater effluence that drain the region and contribute to the increase in the flow of Cafuá.

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