Chapter 93

Experimentation proposal for teaching physics and biological science

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ABSTRACT
This article aims to emphasize experimental proposals for the teaching of Physics and Biological Science in Basic Education, considering that the teacher develops the contents by analyzing the contextualization and experimental activities that elucidate explanations of phenomena observed in everyday life. The reason for carrying out such experiments is to approach and deepen the content, to motivate and arouse interest in the aforementioned disciplines. The connection between science, nature and natural phenomena can contribute to scientific knowledge and for this to be possible, the teacher can elaborate situations of observed phenomena, such as the formation of rainbows, drying clothes on the clothesline, formation of mirages on the road, the formation of images in front of mirrors and their applications in the dental area and in commercial establishments, the phases of matter and its phase changes, the appearance of fungi, how to carry out a selective garbage collection, among countless others experiments that you can build to achieve better quality. All these applications that the teacher can use in the contents of Physics and Biological Science, as a result, seek a better compression of certain contents linked to these disciplines. The article concludes considering that the teaching and learning process will bring the student closer to the phenomena he observes in his daily life, which, consequently, constitutes an effective teaching transmitted by the teacher and thus contribute to better learning and at the same time bring closer the everyday student from the application of contextualization and experimental activity.

Keywords: Teaching Physics, Teaching of Biological Science, Contextualization. Experimental Activity.

1 INTRODUCTION

Experimental activities in the teachings of Physics and Biological Science can be many problems in the teaching and learning process, since the classes being dynamic attracts the attention of the students. For Gonçalves and Galiazzi (2004) there are experimental activities of the "show" type, aimed at stimulating the interest of students in the experiment itself, and the need to go besides the construction of knowledge. In this sense, the student is awakened to a teaching that provokes curiosity in him, besides directing to a dynamic learning in which theory and practice present a much broader sense of knowledge.

For Souto et al. (2015) experimentation is a fundamental activity in the teaching of biological science, physics and etc. that enhances and motivates students, awakening in them reflections on themes

proposed in their broader aspects, promoting a greater incentive and active participation in the development of the class and at the same time, contributing to effective possibility in the teaching process learning. It is verified the relevance of a methodological construction that brings to the educating a concrete meaning from an apprenticeship that does not happen in an abstract way.

One perceives the importance of learning that is not restricted only as a resource the brush and the blackboard that can make the class less attractive where students may not have much participation in student-teacher interaction. However, in view of a methodology developed based on experimental activities, an effective presence and greater student-teacher interaction is perceived. In this respect, Cachapuz et al. (2005) state that depending on how practical activities are conducted in the teaching and learning process, they can favor the way of thinking and attitudes among students, bringing teaching closer to the most relevant aspects of biological science, physical and etc. subjects.

Thus, the methodology should not be developed without practical activity or other resource that is not limited only to slate and brush. The methodological construction must happen dynamically in a horizon in which the acquired knowledge does not happen mechanically. It should be developed with the integral participation of the student and in a teaching and learning situation in which the experimental activity requires greater motivation and interest on the part of the students and that will use or require the analysis and reflections on data of nature (ANDRADE; MASSABNI, 2011).

For Berbel (2011), when the student becomes involved in learning through understanding, he is motivated and interested and started to develop exercise with freedom and autonomy in different situations in which he is based on his daily life. In this respect, Pinto et al. (2013) considers that working with active methodologies develops the living context of learning, stimulates collaborative work by making students work in groups with rhythm, interest and performance in the collective.

Thus, in the group it is the student who seeks learning, being the teacher only a mediator of the process acting between the content taught and the active methodology developed. Regarding the active methodology, Berbel (2011, p. 34), states that, when applied, "students need information, to elaborate and elaborate it according to what they will need to respond to or equate a certain problem proposed in group activity".

Considering this context in which it points out a teaching process with experimental classes and that still considers the development of a methodology presented in the teachings of physics and biological science disciplines from an approach that takes into account not only contextualization, but experimental activity for motivation, interest and greater participation of students according to the approach of the aforementioned authors.

The data collected in this article were acquired via the Internet, based on scientific articles that discuss under this theme presented used qualitative research characterized by presenting several forms of data collection and, one of them is documentary research a valuable technique of qualitative data approach, complementing information to consolidate and deepen theme or problem (LUDKE; ANDRÉ, 1986, p. 38).

Thus, the development of this article was carried out from the documentary analysis technique, seeking as a proposal the use of active methodologies that have as its essence the teaching of biological and physical science to the part of experimental activity based on a contextualization model. In view of the importance of practical activities in the teaching of the aforementioned disciplines, the article aims to present a proposal of experimental activities highlighting as an educational product as suggestions for practical activities, showing that they help in a better quality of teaching.

2 THEORETICAL FOUNDATION

This topic presents a theoretical approach that will support the development and better understanding of what is being proposed in this work.

2.1 PHYSICS TEACHING

Even today with all the technological advances, many students generally do not understand the physical phenomena that are in their day-to-day. It is believed that if the theory is worked in a concrete way, the learning of this science will occur significantly, in order to arouse interest in teaching. The initiative on this issue has as an alternative to make the student understand the physical phenomenon in daily life and develop a logical reasoning, based on observations and experimental activities related to science (GUIMARÃES, 2009).

In order for the teacher to be able to motivate the student needs to evaluate how he can develop the theory of Physics or biological science with the initiative to arouse his curiosity, interest and motivation. In view of the skills and competencies of the National Curricular Parameters (PCN's), 2001, the teaching of physical should be taught in a way that makes students learn to observe nature, understanding the phenomena included in the daily life they experience.

Physics corresponds to a discipline that comes to be seen as an instrument for understanding the world. Thus, the teacher should pay close to a methodology of teaching Icain which the interaction with natural phenomena is perceptible to the student, because teaching should not be restricted in the presentation of concepts, laws and formulas, in a disjointed way, distanced from the world lived by students and teachers and not only, but also for this, voids of meaning but must happen at least and with naked privilege m development where practice and examples are concrete (BRASIL, 1999, p. 48).

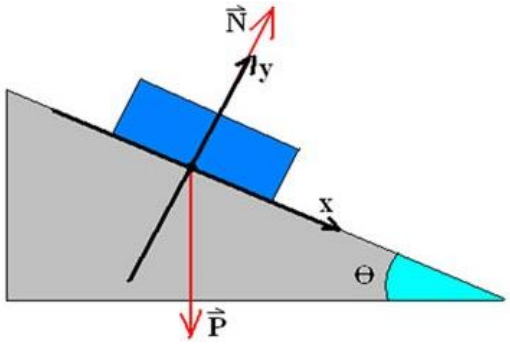
2.1.1 Understanding, observation and procedures of a physical phenomenon

The student is interested in a knowledge that makes him curious and seeks to explore the environment that surrounds him, observing, reasoning, making speculations and trying to know the reason for a given problem. It is in search of this curiosity to learn that the teacher must have the audacity to offer a methodology that makes the student understand how he can understand the world around him, however, there are other reasons besides mere curiosity. It is those of a practical order that lead to trying to discover

the laws that govern physical phenomena, because numerous times the knowledge of such laws allows them discoveries and inventions of great practical utility (DELIZOICOV; ANGOTTI, 2009).

Performing an experiment means doing certain manipulations with certain bodies, to verify how they behave under certain circumstances. Just by way of illustration, it supposes to suggest an extremely simple experience, which can be carried out anywhere, without any rigging. Be given a book, and on it, one puts a body of mass m. In the horizontal position, the body is immobile (**Figure 1**).

Figure 1: A book placed on an inclined plane is subjected to weight force, frictional force and normal force to the surface of the inclined plane.



Source: https://www.preparaenem.com/fisica/plano-inclinado.htm

Then a slope slowly takes place on the surface on which the book is found. Initially, it will remain immobile, because friction prevents its slippage. However, when the angle formed by the surface with the horizontal reaches a certain value, it will begin to slide. Repeat the experiment using another body, another flat-based object. Is the angle at which the object begins to turn off the same? To answer this question, an experiment is made with different objects and checking the behavior and angle that each object is on the iminence of slipping.

In the vertical direction in moving the object, the intensity of the resulting force can be given by the following expression:

$$R = F_y - P_x \qquad (1)$$

the represents the frictional force that is proportional to the mg weight of the object and is the horizontal component in the direction of the object's movement. $F_y = \mu . mgP_x$

Soon

$$m.a = \mu.N - mg.sen\theta = \mu.P_y - mg.sen\theta = \mu.mgcos\theta - mg.sen\theta \qquad (2)$$

or

$$a = g(\mu cos\theta - sen\theta) \qquad (3)$$

If the body glides with uniform movement, it is

$$\mu = tg\theta \qquad (4)$$

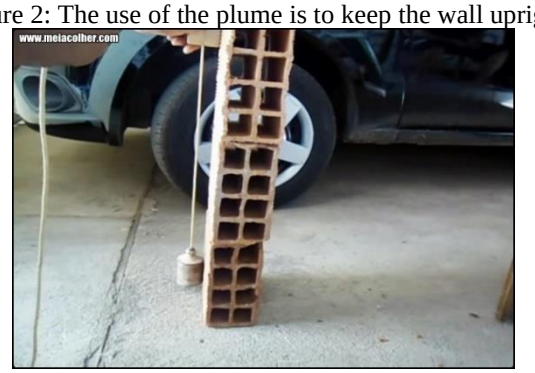
Therefore, when the object is on the imminence of the movement, it is possible to evaluate the coefficient of friction using an instrument that can measure the angle of inclination at which the inclined plane is located. Therefore, it is possible to build a table with different objects placed on the inclined plane, such as rubber, wooden block, etc.μ

Experimenting with multiple objects, it will be verified that the smoother the object and the base, the smaller the angle at which the object begins to slide (**expression 4**). The description of this experience, despite its great simplicity, allows to make a series of considerations about experience as a means of investigating the laws of nature. These types of experiments and so many others can be used in the classroom in which the teacher can explain in the initial series the first concepts of physics introducing friction and other quantities involved in these types of physical phenomena.

It is in fact based on the procedures that the questions arise, verifying the physical laws that can govern a certain phenomenon. Questions are important to go in search of interpreting physical phenomena, such as why objects fall and how hard are they pulled from falling? Why does the mason wear a feather when he builds a brick wall?

To answer this question, the teacher can take a plume and about 6 (six) bricks to show the importance of the plume to weave a brick wall in a construction (**Figure 2**)

Figure 2: The use of the plume is to keep the wall upright.



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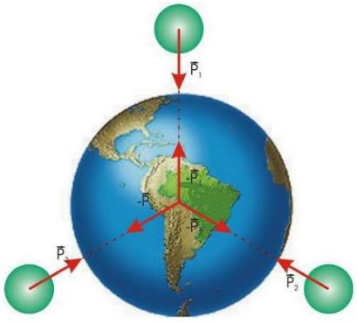
To explain the reason for this practice of using the plume to leave the wall tilted is due to the earth "pulling" the bodies always in the radial direction (**Figure 2**)

Figure 3: Earth exerts a gravitational force that has a radial direction



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The seas so many other questions can be explained by taking into account the theory of Gravitation Universal and the teacher should build a methodology capable of asking questions like these to be answered from experimental activities that help students to have a greater approximation with the physical discipline (REIS; SILVA, 2013).

2.1.2 Experience, Methods and Physical Laws

Based on what was previously exposed, the learner must understand the purpose of a scientific experiment. The experience serves to increase his knowledge by observing the phenomenon in certain circumstances. Physical and biological phenomena are directly part of your daily life, such as cooking, bread bolô, washing clothes and drying in the sun, combing hair and others. Numerous phenomena can be used to understand the teaching of Physics and Biological Science.

Thus, it can be said that experience is a question that the student asks nature. It is up to him to carefully observe the phenomenon and draw the correct conclusions of everything he observes and from there I opened the dialogues with the teacher to elucidate and understand in the light of mathematical and physical formalism that requires the interpretation of everything he verifies in practice.

It is up to the teacher in his role as a natural scientist to observe the occurrence of phenomena around him and analyze them, trying to describe them, in a language focused on education discovering the regulations in their manifestations. It is also responsible for predicting its occurrences, explaining the reasons for its production and its regularities. As results of this study, they arise to physical laws that can be carefully adapted for teaching.

In view of the observation of phenomena and considering experimental activity, Araújo and Abib (2003) sought to highlight the relevance of the use of experimentation, which according to them has been a promising teaching tool, because it excludes the student from a technical theory and leads him to a reality of practical life. Another fact of interest to the educational process is that experimentation has been the subject of a study by several authors (SILVA, 2010) and (OLIVEIRA, 2010) representing in a collection of results that has this mold that expands in the creation and publication of a vast bibliography on the theme that evidences the experimental activity where the advantages are investigated, the importance and trends that arise with application in physics teaching.

Inreltion to this relevance, Batista (2009) states:

> Experimentation in physics teaching does not summarize the entire investigative process in which the student is involved in the formation and development of scientific concepts. It should also be considered that the process of learning scientific knowledge is quite complex and involves multiple dimensions, requiring the student's investigative work to take several forms that enable the triggering of different cognitive actions, such as: manipulation of materials, questioning, right to groping and error, observation, expression and communication, verification of the hypotheses raised. We can say that this is also a work of analysis and synthesis, without forgetting the imagination and enchantment inherent to investigative activities.

Thus, Batista (2009) considers that with experimental activity brings in its bulge a deer of situations that goes from the simple level to the most complex, however, the student is related to motivation and interaction between all which allows greater learning, because it is considered that the use of experiments in the school institution represents a promising method for the teaching of Physics that as already mentioned above, interactions take place through dialogue and in the exchange of information between all involved.

2.2 BIOLOGICAL SCIENCE AND RELEVANCE TO MAN

Biological Science Studies living beings, that is, specifically characterized by the study of life. Its scope is the functioning of living organisms from the molecular and subcellular scale at the population level, as well as the interaction of life with its physical-chemical environment that contribute to consolidate and deepen the study in this scientific area.

It is intended to explain phenomena related to life and its origin, which is why it intrigues, motivates and awakens the reader by this fascinating world of living beings. Due to the great diversity of living beings and the enormous specialization of the areas of study, biological science becomes a very engaging science, which expands interpersonal and interdisciplinary relationships with other areas, such as physics, chemistry, geography and even mathematics.

Like physics, biological science is present in virtually everything in nature and directly influences the life of man and society, which highlights it as a science of great importance and its knowledge contributes to relevant issues, such as preservation of the environment, functioning of biological processes, knowing various hereditary pathologies, such as hypertension and physical activity, understand the human limits to treat certain diseases of a hereditary nature. The numerous subdivision of biological science enables man to be able to understand a broad area of knowledge that contributes to improving life in society.

2.3 PROPOSED TEMA FOR THE TEACHING OF BIOLOGICAL SCIENCE AND THE INSERTION OF

It is interesting that the teaching of biological science was developed with a teaching methodology in which the student had a greater contact with reality through the content that involved the learning of everyday life. Thus, the teaching and experimental of biological science could happen from concepts and

valorization of the use of a practical approach in the search for a better understanding of teaching that happened learning taking into account the daily life of the student (VASCONCELOS, 2002).

In this sense, the realization of a practical-experimental approach in the teaching of Biological science as a proposal for the teaching of process and learning with this pedagogical practice, could alleviate much of the problem that happens when the teacher teaches the content without the use of any other resource. Under the question of methodological construction with contextualization insertion made possible by practice, Nardi (1998) shows that the absence of experimental activities is often pointed out by teachers as one of the main deficiencies in the teaching of scientific disciplines in elementary and high school.

It is verified that the author considers that the lack of contextualization both in the area of biological science and in other areas such as physics, require methodological innovations so that the classes do not become monotonous, which in a way hinders learning, as stated by the author cited. In this case, it is necessary that the teacher evaluates his methodology, seeking a way around the problem, making the educational work he develops have a greater meaning for the student (MORAIS; ANDRADE, 2010).

It is interesting that the teacher outlines some relevant points of an essential nature to perform as a teaching methodology in biological science classes. The first strategy would be to consider in your classes the experimentation that is the basis to prove the theory of a given content. The introduction of experimentation that could be carried out in a laboratory available in the school where the teacher can divide the class into teams to start the tasks and perform the experimental activities to be developed by the teams under the supervision of the teacher. The reason for introducing experimental activity has the advantage of facilitating the understanding of the content that was developed, theoretically.

Experimentation as an introduction and contextualization of content leads students to take initiatives such as seeking, discovering, constructing, criticizing, comparing, dialogizing, analyzing, experiencing the process of knowledge construction itself (ZABALA, 1998). If the teacher does not seek experimentation or contextualization in his classes, it is believed that most students will have learning problems that may be precisely tied to a traditional education system that are characterized in obtaining mechanical activities (MIZUKAMI, 1986).

3 MATERIALS AND METHODS

In this section, we try to show experimental proposals to be used for the teachings of Physics and Biological Science, considering as resources low cost subjects that the teacher can use to make the classes of the aforementioned disciplines much more interesting, avoiding only theoretical or mechanized development that can hinder the teaching process and make the classes less interesting.

In this respect, Delizoicoy and Angotti (2000) consider an experimental work more convenient than the discussion and interpretation of results obtained with the professor acting in order to present and develop concepts, laws and theories involved in experimentation. With experimentation it sharpens and motivates

the student to better understand the theories involved in the observed phenomena. For Bizzo (2002, p. 75) shows that:

> (...) the experiment alone does not guarantee learning, as it is not enough to modify the way students think, which requires constant follow-up from the teacher, who should research what are the explanations presented by the students for the results found and propose, if necessary, a new situation of challenge.

Bizzo considers in this quotation that science has its foundations in of the important stages that is theory and practice. However, it is necessary to have a mediator between the student with practice and theory so that it increases the interest on the part of students, which in a certain way, makes him face challenges and creates the possibility of a better understanding of nature being of great interest to him (BIZZO, 2002).

3.1 EXPERIMENTAL PROPOSAL FOR TEACHING PHYSICS

Teaching Physics to students can be a challenge for the teacher if he builds a methodology only from a theoretical point of view. However, it is interesting to elaborate contents where experiments can be dissecting that can make the student sharpen the mind for many phenomena that are inherent in his daily life. Therefore, this proposal to develop physics experiments could be very useful because it could acquire a greater knowledge of physics, which would help to understand the various natural phenomena.

On the issue of the teacher offering different activities that students can perform, they can manifest acceptance or rejection behaviors of the content they learn (FRACALANZA; ADAM; GOUVEIA, 1986). It is necessary that the teacher can make an approach that will hold the attention of students and teach them to understand teaching about two important aspects that are theory and experiment.

However, the teacher can build a methodology with a collection of experiments that he/she can develop with low-cost materials and show in the teaching and learning process some physical phenomena that the student has affinity and observes, but that does not know the reason why it happens. Analyzing this context, it is shown below, some experimental proposals that the teacher can develop and explain, based on content, without, however, resorting to mathematical formulations or physical laws for a much more in-depth explanation.

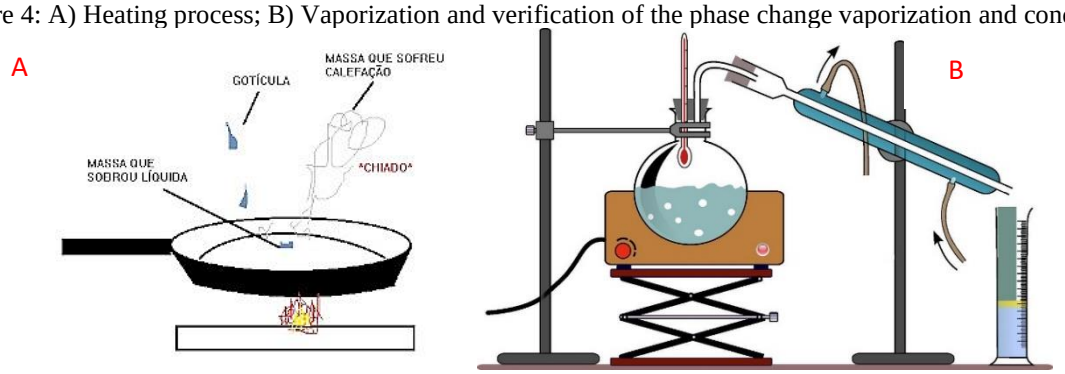
In relation to this argument, Arruda and Laburu (1998) share this idea when they affirm the need to adjust theory with reality, and science is an exchange between experiment and theory, in which there is no final truth to be achieved, but only the theory serving to organize the facts and experiments, adapting the activity, shows the emphasis that teachers give to the objectives of mechanical knowledge, which generates prejudice to the objectives of understanding science or the development of attitudes.

3.1.2 Phase change

To explain this experiment, it aims to show that matter can be found in three phases: solid, liquid and gaseous (**Figure 4**). When opening the refrigerator, the student can observe the formation of ice in the freezer having contact with the solid phase of the matter, when opening the tap the liquid phase and in the kitchen can observe the formation of steam coming out of the pressure cooker, the gaseous phase. This fact, routinely observed, can be used by the teacher in the classroom or in an interdisciplinary laboratory to explain the three phases of the subject. So he can take to the classroom the three phases of water and show how the child can understand in everyday life the phases and changes. As for the materials used to explain the change of water phase, the teacher may use the following materials**:**

1- um aluminum container;
2- um stove to heat the container;
3- um graduated container to measure the amount of water.

Figure 4: A) Heating process; B) Vaporization and verification of the phase change vaporization and condensation



Sources: A) https://vestiburlando.wordpress.com/2012/09/26/fisica-vaporizacao/; B) https://descomplica.com.br/artigo/condensacao-quimica-causas-e-exemplos/TTn/

To carry out the experiment the teacher can use the container and measure 500ml of water and pour it into the aluminum container for heating. After a while while the water is in the boiling process in the open container and already at a temperature of 100ºC, it shows the students the transformation of the phase from liquid to steam. To verify that part of the water escaped into the environment in the form of steam, it uses the graduated container at the second moment and shows the students that the volume obtained was less than 500ml, explaining that the water underwent phase change, losing part of the liquid in the form of steam to the environment.

Based on this experience, you can then explain why clothes dry on the rods (The teacher can explain the reason for this, considering the change of phase from liquid to steam, in the same way that the puddle of water happens), the puddles of water dry up (On a sunny day, the teacher can explain that a can of water gradually disappears, due to the water passing from the liquid phase to the steam phase and introduce that to this change it is called evaporation) and that on a rainy day, it can consider that the water vapor of rivers, lakes and cans that have turned into steam, when it reaches cold regions, passes from the state of steam to the liquid giving this change of condensation.

To teach about sublimation, the teacher can take to the classroom a mothballs (white bolinas in the shape of an ellipsoid or spherical), showing the initial size and after a few days, show the children and ask why the size got smaller? Based on this experiment, the professor may consider that when the matter passes directly from the solid phase to the vapor phase, this phase change is called sublimation. It is verified, therefore, that from simple experiments, the teacher can explain the content of changes in the phases of the subject. To make the lesson much more interesting, the teacher can take illustrations of figures where students check the reason for in practical terms to observe the reasons for seeing these everyday situations.

3.1.3 Light Ray: laws of refraction and reflection

(A) Tombstones submerged in half a glass of water

For the teacher to explain that some objects submerged in water learn "broken, he can bring to the classroom the following materials:

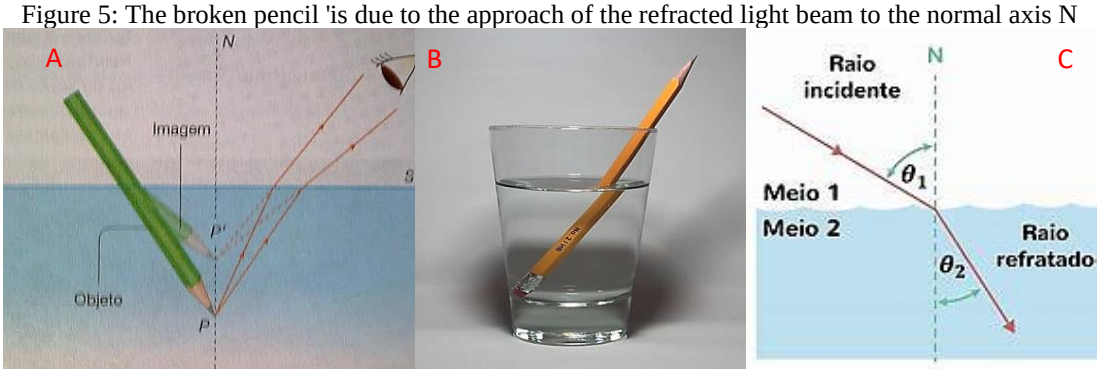
1- colorless glass container;

2- 100ml water to enter into the 250 ml container;

3- um pencil

The teacher to perform this experiment and show the law of refraction, asks students to insert the pencil inside the container. The teacher asks students to observe the immersed and submerged part of the pencil, considering that in the submerged part the students are seeing only the reason image that explain the appearance of the "broken" that happens due to an approximation of the light ray approaching normal (**Figure 5**).

Figure 5: The broken pencil 'is due to the approach of the refracted light beam to the normal axis N



Source:(A) https://pt.slideshare.net/joaopaulosouzasimaodasilva/fsica-2ano-g (B) https://www.bing.com/search?q=lapis+num+copo+d%C3%A1gua+lei+da+refra%C3%A7%C3%A3o.&cvid (C) http://blog.biologiatotal.com.br/refracao/

To instruct on the refraction of light for students, a simple experiment, would be to fill half a glass with water and insert inside a pencil and ask them to observe what happens to the pencil before and after being inserted into the liquid medium. The teacher can make inquiries showing why the pencil suffered a "break" when inserted into the liquid and remained straight when in mid-air. Thus, it induces the students'

curiosity for a better understanding of the refraction of light. The teacher may apply an exercise where he teaches how to determine the refracted angle from the law of the refraction of the monochrome radius, this

$$n_1 \text{sen}\theta_1 = n_2 \, \text{sen}\vartheta_2 \qquad (5)$$

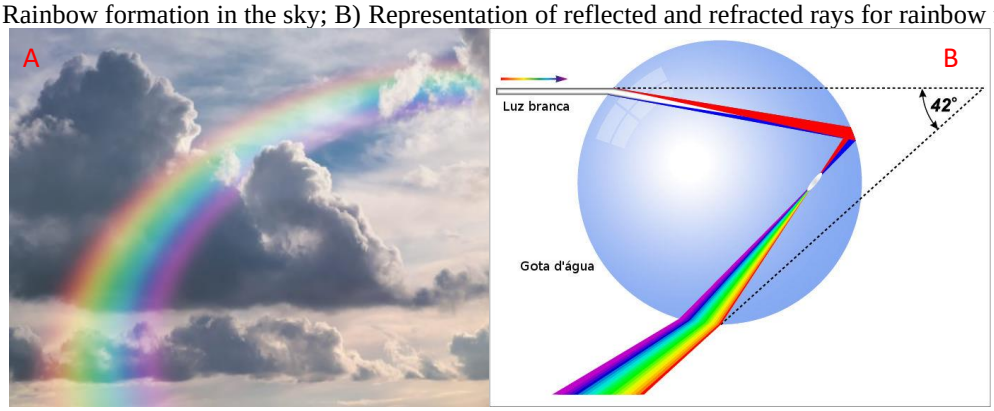
B) The formation of rainbow in the water drops

Another interesting experiment would explain the formation of the rainbow, being formed and formed when the sun's rays are held by a drop of water coming from the atmosphere and causing a part of the rays to be "cast" into the water drop, reproduced inside it, and then " cast" back out of the drop. The teacher reports the importance of the sun for the formation being responsible for the lighting of moisture suspended in the air.

The density difference between water and air causes the light to pass from the air to a drop of rain causing a change of direction, similar to the pencil submerged with water in a glass. When the light penetrates into the water drop, it undergoes refraction and reflection, followed by yet another refraction out of the drop. To better explain the phenomenon of the rainbow, the teacher may represent light as rectilinear rays considering the difference of homogeneous, translucent and transparent means, emphasizing the issue of the view of certain sharp and translucent objects in terms of rays of light.

White light called sunlight decomposition and displays a spectrum of colors as shown in figure 6. After the formation of the rainbow that happens in the clouds loaded with water droplets, it can show the formation from the construction that detail how the refraction and reflection of light happens in the droplet, resulting in the formation of it. In this case the analogous phenomenon would be the decomposition of light through a prism (**Figure 6**) as Newton did.

Figure 6: A) Rainbow formation in the sky; B) Representation of reflected and refracted rays for rainbow formation



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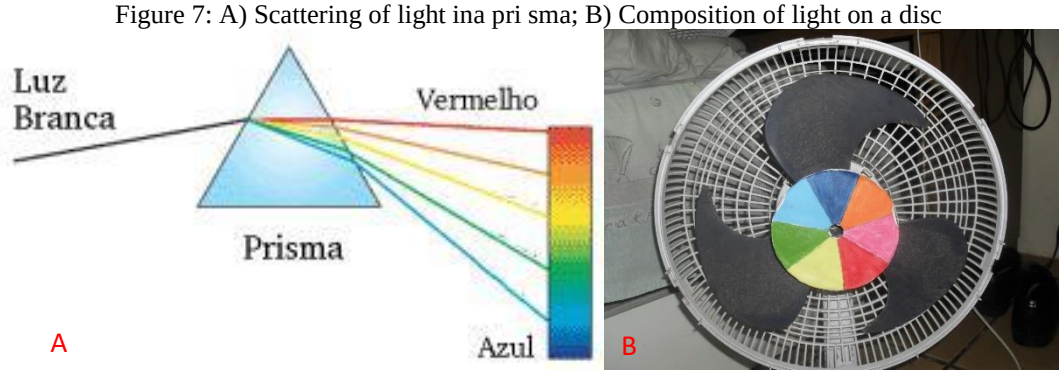
(C) Dispersion and composition of naked lightm prism and on a Newton disc

One way to explain that white light from the sun is formed in various colors, the teacher can bring to the classroom a glass prism and a disc (known as Newton's disc (**Figure 7**:)

Figure 7: A) Scattering of light ina pri sma; B) Composition of light on a disc



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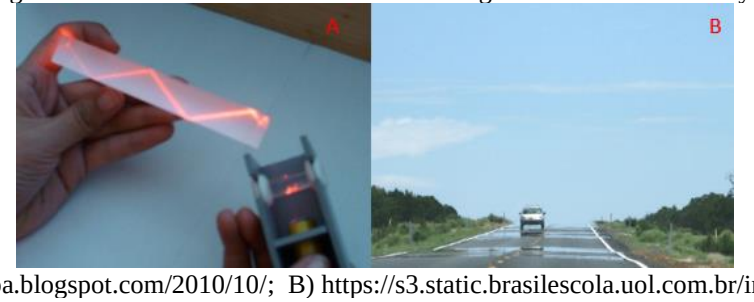
For the student to understand that light is composed of several colors, the teacher can use newton discs as an experiment and from a polychromatic light source, asks students to direct the source to the prism. However, the environment must be prepared for all students to perceive the formation of image spectra from the other side of the prism. To broaden the discussion on this theme of geometric optics, the teacher can present videos or images that explain the emergence of optical phenomena such as "wet road".

D) Wet road

Mirages represent important applications of total light reflection. To explain some mirage phenomena, the teacher could take students on a road trip on a sunny day and show that in some parts of the road, the phenomenon of mirages happens. They'll check for the appearance of water and mirrored cans, but when they get closer, they'll find they were just mirages.

To explain the formation of the mirage the figure **(Figure 8**), shows that the surface acts as a mirror that happens due to the total reflection of light on the surface that happens on a hot day, because the Sun heats the asphalt, which heats the air above it. However, they consist of two layers of air of different densities and different temperatures. The light ray when crossing these layers, suffers refraction and consequently, total reflection. The observer sees a double sky, the first by the light that goes directly to the eyes and the other by the light that was supposed to reach the asphalt, but was redirected because of total reflection.

Figure 8: Phenomenon of "wet" road according to total reflection of rays

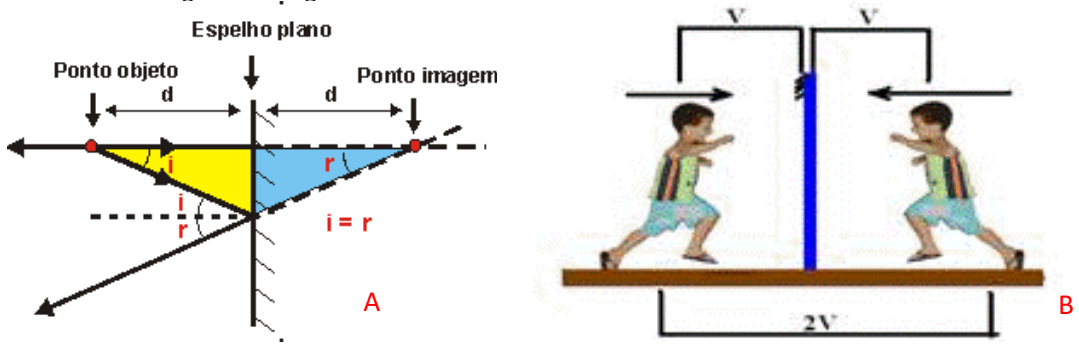


Source: A) http://profbiriba.blogspot.com/2010/10/; B) https://s3.static.brasilescola.uol.com.br/img/2017/02/miragens-no-asfalto.jpg

E) Image form in a flat mirror

The law of light reflection is very common in the formation of images when an object is in front of the mirror. Because the mirror is flat, the image formation is the same size and distance as the object. To show this property, the teacher can take to the classroom a mirror and ask the children to stand before him. In the sharpness of the image, size and shape he can explain using some measurement instruments in order to make it clear beyond explaining that the image is formed behind the mirror (**Figure 9**).

Figure 9: Images of the same size and of mesma distance in a flat mirror



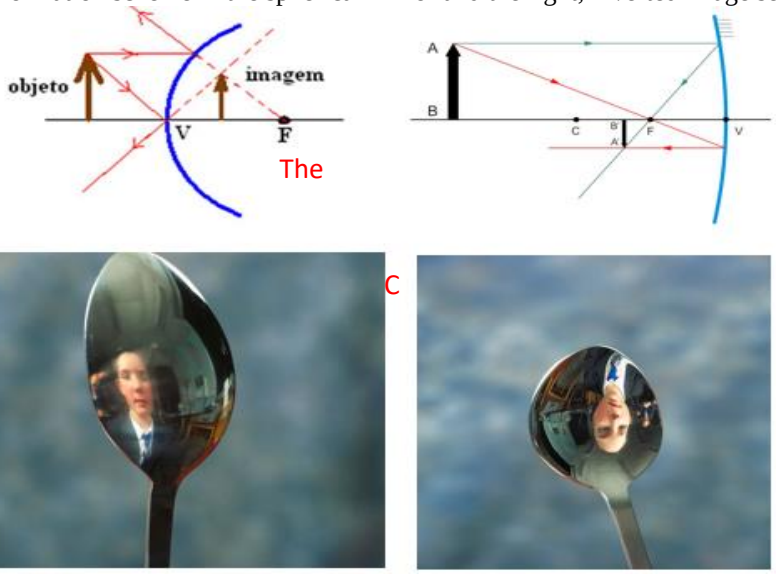
Sources: A) https://th.bing.com/th/id/R.e4794ca57fc8fea925e9367b52e0ce60?rik=220etk7vzll7ew&riu=http%3a%2f%2falfaconnection.pro.br%2fimages%2fLUZ030103a.gif&ehk=RspoxY7EQaOYrDU9QGfag2%2bMMRCMGAeWitIPYm7O7JI%3d&risl=&pid=ImgRaw&r=0; B) http://profemmanoel.blogspot.com/2016/12/espelhos-planos.html

F) The formation and application of image in a convex and concave mirror

However, in addition to the flat mirror, the teacher would explain that there are still so-called spherical mirrors that characterize by presenting a curvature and an internal mirroring (concave mirror). If mirroring is external (convex mirror) it may explain that scattering happens on the outside of the curvature. To make these denominations clear, he can bring convex and convex spherical mirrors to the classroom and have students observe the images formed in the two curvatures.

For convex spherical mirrors, they can be used in commercial establishments to have the widest viewing range, ensuring the safety of the establishment, currently, convex spherical mirrors are being replaced by security cameras. The teacher to explain the usefulness of the concave mirror, can question students on the issue of the dentist where he uses a small mirror that inserts into the interior or upper part of the patient's teeth. The teacher should explain why the dentist approaches the mirror, considering that the image of the object is larger with the approximation. As for the formation of the nature of the images, he can use a stainless steel spoon and ask students to observe both sides (**Figure 10**).

Figure 10: Image formation scheme in the spherical mirror and the right, inverted image seen on a spoon



Fontes: A) https://mundoeducacao.uol.com.br/fisica/formacao-imagens-espelhos-esfericos.htm
B) https://docplayer.com.br/107620633-Os-espelhos-esfericos-conjugam-imagens-com-diferentes. html; C) inverted-reflection-in-a-spoon-andrew-lambert-photography.jpg (500×700) (fineartamerica.com)

Everyone will verify that in the concave part the image is inverted and that in the convex part is right. To explain this interesting optical phenomenon, the teacher can use the analytical part by constructing images that position the object at different points in the front of the concave and convex mirrors so that students are familiar with the mathematical calculations obtained from the following expression:

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{p'} \qquad (6)$$

where f is the focal length of the spherical mirror, p is the position of the real object placed in front of the mirror and p' the real or virtual position of the object.

3.2 EXPERIMENTAL OPPOSITE FOR THE TEACHING OF BIOLOGICAL SCIENCE

The teaching of Biological Science focuses on the study of life in its different forms therefore, the teacher needs to teach the student how it is organized, its relationship with medium, its reproduction and evolution not limited to natural means, but explain how the human being can also interfere in this process.

However, teaching these contents can become tiring only by theory to the student, in addition, for some matters of biology it is necessary to make use of laboratory so that they better fix the knowledge, but many schools do not have it which makes it even more difficult for the teacher and the student.

Thinking about this and other problems that can harm the teacher's teaching and knowing that experimental activities are important for the consolidation of knowledge by the student this work selected some practical experimental proposals to be used in the teaching of Biological Science, with elements used in daily life to help both the teacher to teach, and for the student who will learn that new knowledge without difficulties.

3.2.1 Fungi

They are roughly divided into filamentous fungi (molds) and yeasts. Its occurrence is more common in foods with low percentage of water and/or high percentage of lipids such as almonds and chestnuts. Fungi (Figure **11) are the** main biological hazards of these foods, their risk is in the production of mycotoxins by some species. These compounds when ingested accumulate in the body causing a number of disorders, from attacks on the liver to some types of cancer.

Figure 11: The presence of fungi in food A) the bread mold; B) In orange; C) On banana

Sources: A) https://www.worldbulletin.net/images/resize/100/656x400/haberler/250x190/2011/12/30/fungi_1.jpg; B) https://www.brasilblogado.com/wp-content/uploads/perdas-na-pos-colheita-02.jpg; C) https://th.bing.com/th/id/OIP.ZIsZSGlNStJ71TOajaQRBAHaGi?pid=ImgDet&rs=1

To teach about the content of fungi the teacher can take to the classroom a mushroom, bread and common fruits of human food, already infested with fungi and start the class asking questions to his students if they had already witnessed something similar and if they know why these foods are in that state, urging them to be interested in the subject. From the answers he introduces about fungi explaining their characteristics, reproduction and classification.

3.2.2 Selective collection of garbage at home

Selective **garbage** collection is extremely important for society. Through it, all waste is properly disposed of and prevents pollution of soil and groundwater, in addition to avoiding pollution of streets and sewers that can cause flooding and, consequently, major damage to public coffers and city dwellers.

There is the Selective Collection of Hazardous Waste **(Figure 12)**, generated by several sectors that may pose a danger to the health of people exposed to them, such as debris from chemical and industrial processes, which can contain flammable, corrosive and toxic characteristics, something that makes its handling completely risky. Because of this, the collection of hazardous waste should always be done by a company specialized in the transport of this waste, as is the case of waste All.

Figure 12:The types of residues can be classified according to origin, chemical composition and dangerousness

Source: A and B - Do you know all kinds of waste and the dangers they present? (residuoall.com.br) C - https://www.pensamentoverde.com.br/dicas/coleta-seletiva-separe-o-lixo-domestico-de-uma-forma-simples-e-rapida/

To contribute to selective collection, it is necessary to take some care when separating the garbage so as not to cause major environmental damage or to make the use of waste unfeasible. An environmental logistics company was able to manage the waste in a simpler way, disparaging waste into only two categories: dry waste, such as cans, paper, plastic and glass; and moist or organic, such as leftover food.

An experimental proposal for the teacher to teach about the importance of selective garbage collection for the environment is to show in the classroom what each color represents and where each garbage needs to be placed, for example, red - plastic, blue - paper, green - glass, brown - organic, yellow - metal. Challenging them at the end of the lesson, to do an activity lasting two days in which they must observe the garbage of their homes and make the separation, according to the colors, in boxes or bags, registering them on a paper what was placed in each one (**Figure 13**).

Figure 13 :Colored waste cans for selective garbage collection

Source: https://tnaplast.com.br/voce-conhece-as-cores-da-coleta-seletiva/

3.2.3 Building a classroom ecosystem

On the Internet the teacher can have access to various ways of assembling a terrário, a small sample of an ecosystem in closed container, from the simplest to the most complex. And for the class to be involved in this construction, he can ask each student to bring a type of material that will be needed for construction (**Figure 14**).

Figure 14: Implementation of an ecosystem carried out in the classroom to understand its functioning

Source: https://produto.mercadolivre.com.br/MLB-1642246278-terrario-montado-em-pequeno-aquario-_JM

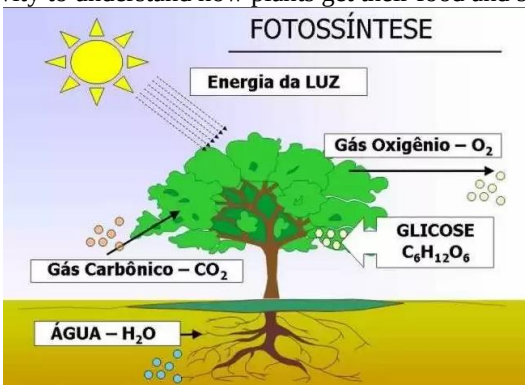
With the terrário ready the teacher can explain several subjects such as the water cycle, explaining why the container wall was blurred after a while, as a consequence of the change in the state of the water. In addition, the teacher will still be able to explain about the soil and its different forms. Always allude to the larger ecosystem, planet Earth.

3.2.4 How do plants feed?

One or two classes before this activity, ask students to bring to school the following material: a glass jar (clean, unlabeled and lidded), a roll of insulating tape, plant seedlings (they can be varied plants, but I recommend the use of grass seedlings – it is easy to get seedlings with root and are relatively resistant). The teacher, in turn, can arrange a bag with dirt and another with sand and some sticks for the assembly of the experiment. It can also bring some plant seedlings (there are always students who "forget") and a pen for overhead projector (to write down the names and date on the vials).

Mounting the Experimental Ecosystem is simple: instruct students to put some sand at the bottom of the bottle and then cover it with dirt (about twice the amount of sand). Then the seedling of the plant is placed, using the sticks to bury its root. Finally they should add some water (very little even, unless the earth is too dry), cap the bottle, seal it with the insulating tape and identify it with its name and date (a label can be glued or written directly on the glass with an overhead projector pen (**Figure 15**).

Figure 15: Experimental activity to understand how plants get their food and survive on the planet



Source: https://www.gpabrasil.com.br/wp-content/uploads/2017/11/fotossintese.jpg

With this activity the teacher will be able to explain to his students in a simple way the process by which plants get their food and survive on the planet, through the process of photosynthesis. In addition, it can go out with students so that they have contact with outdoor plants and thus explain the importance of light, the carbon that comes out through breathing, and water, simpler elements of this process, which are necessary for the survival of plants.

4 CONCLUSION

In view of what was developed in this article, it was noticed that it is necessary that the teacher to introduce new concepts should make observations of the phenomena that are part of the daily life of the student. Thus, being able to extrapolate to the abstract subject, such as the insertion of contextualization and experimental activities as teaching strategies addressed in the context of this article.

It should also show in the experiences the physical phenomena and always make the possible observations with the student to achieve an effective teaching of Física and Iological Science B, and it is necessary that there is an efficient mediation of it with the experiments and contextualization from dialogues that can happen during the teaching process in the classroom or in laboratories that elucidate analysis of phenomena and experiments linked to the theory developed.

The teaching of Physicsand Iological Science Bin the way mentioned in this article can offer the conditions of identifying and understanding methodologies based on contextualization and experimental activity. In the case of Physics, enunciate basic concepts for explanations in a simple and clear way at the level of the student, using analogies and situations of real life so that the teacher and can situate the student in time and space with classes that are able to promote to him an effective teaching rich in information brought from contextualization and experimental activity.

REFERENCES

ANDRADE, L. F. de; MASSABNI, V. G. **O desenvolvimento de atividades práticas na escola**: um desafio para os professores de ciências. Ciência & Educação, v. 17, n. 4, p. 835-854, 2011.

ARAÚJO, Mauro Sérgio Teixeira de; ABIB, Maria Lúcia Vital dos Santos. **Atividades experimentais no ensino de física**: diferentes enfoques, diferentes finalidades. Pesquisa em Ensino de Física. Rev. Bras. Ensino Fís. 25 (2). Jun 2003.

ARRUDA, S. M. e LABURÚ, E. **Considerações sobre a função do experimento no ensino de Ciências**. In: NARDI, R. (org.) *Questões atuais no ensino de ciências* São Paulo: Escrituras, 1998.

BATISTA, Michel Corci., FUSINATO, Polônia Altoé., BLINI, Ricardo Brugnole. **Reflexões sobre a importância da experimentação no ensino de Física**. Acta Scientiarum Human and Social Sciences, 2009.

BERBEL, Neusi Aparecida Navas. **As metodologias ativas e a promoção da autonomia de estudantes**. Semina: Ciências Sociais e Humanas, Londrina, v. 32, n. 1, p. 25-40, jan./jun. 2011.

BIZZO, Nélio. **Ciências**: fácil ou difícil. São Paulo: Ática, 2002. p. 74-75.

BRASIL, MINISTÉRIO DE EDUCAÇÃO E CULTURA. **Parâmetros Curriculares Nacionais**: Ensino Médio. Brasília, 1999.

CACHAPUZ, A. et al. (Org.). **A necessária renovação do ensino de ciências**. São Paulo: Cortez, 2005.

DELIZOICOV, D.; ANGOTTI, J.A. **Metodologia do Ensino de Ciências**. São Paulo: Cortez, 2000.

FRACALANZA, Hilário; AMARAL, Ivan A.; GOUVEIA, Mariley S. Flória. **O ensino de ciências no primeiro grau**. São Paulo: Atual, 1986.

GONÇALVES, F. P.; GALIAZZI, M. do C. (2004). **A natureza das atividades experimentais no ensino de ciências: um programa de pesquisa educativa nos cursos de licenciatura**. In: Moraes, Roque e Mancuso, Ronaldo (Orgs.). Educação em ciências: produção de currículos e formação de professores. Ijuí: Editora Unijuí.

GUIMARÃES, L. R. Série Professor em Ação: **Atividades para Aulas de Ciências, Ensino Fundamental 6° ao 9° ano**. São Paulo: Nova Espiral, 2009.

LUDKE, M.; ANDRÉ, M. E. D. A. **Pesquisa em educação**: abordagens qualitativas. São Paulo: EPU, 1986.

MIZUKAMI, M. da G. N. **Ensino**: as abordagens do processo. São Paulo: EPU, 1986. 119 p.

MORAIS, M. B.; ANDRADE, M. H. de P. **Ciências**: Ensinar e Aprender. 1ª ed. Belo Horizonte: Dimensão, 2010.

NARDI, Roberto. **Educação em ciências**: da pesquisa à prática docente. Escrituras editora, 1998.

OLIVEIRA, Jane Raquel Silva. **Contribuições e abordagens das atividades experimentais no ensino de ciências**: reunindo elementos para a prática docente. Acta Scientiae, v.12, n.1, jan./jun. 2010.

PARÂMETROS CURRICULARES NACIONAIS – PCN. **Ciências Naturais**. 3. ed. Brasília: Ministério da Educação/Secretaria da Educação Fundamental, 2001.

PINTO, Antonio Sávio da Silva; BUENO, Marcilene Rodrigues Pereira; SILVA, Maria Aparecida Félix do Amaral e; MENEZES, Milena Zampieri Sellman de; KOEHLER, Sonia Maria Ferreira. **O Laboratório de Metodologias Inovadoras e sua pesquisa sobre o uso de metodologias ativas pelos cursos de licenciatura do UNISAL**, Lorena: estendendo o conhecimento para além da sala de aula. Revista de Ciências da Educação, Americana, Ano XV, v. 02, n. 29, p. 67-79, jun./dez. 2013.

REIS, Elival Martins., SILVA, Otto H M. **Atividades experimentais**: uma estratégia para o ensino da física. Cadernos Intersaberes, vol. 1, n.2, p.38-56, 2013.

SILVA, Maurício Nogueira Maciel., FILHO, João Bernardes da Rocha. **O papel atual da experimentação no ensino de física**. XI Salão de Iniciação Científica – PUCR, 2010.

SOUTO, E. K. da S. C. et al. **A utilização de aulas experimentais investigativas no ensino de ciências para abordagem de conteúdos de microbiologia**. Experiências em Ensino de Ciências, v. 10, n. 2, 2015.

VASCONCELOS A. L. S., COSTA, C. H.C., SANTANA, J. R. E CECCATTO, V. M. **Importância da abordagem prática no Ensino de Biologia para a Formação de Professores** (Licenciatura Plena em Ciências / Habilitação em Biologia/Química - UECE) em Limoeiro do Norte – CE / Curso de Licenciatura em Ciências da Faculdade de Filosofia Dom Aureliano Matos em Limoeiro do Norte – CE, 2002.

ZABALA, A. **A Prática educativa**: como ensinar. Porto Alegre: Artmed, 1998.