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Practical lessons: Important tool in the Natural Science teaching

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Abstract: The practical lessons are a powerful tool for the learning process improvement in science subjects, especially in chemistry field, as they provide a better association of practice and theory, problem solving and daily inquiries. This project aimed to enhance and encourage learning in science as well as collaborating with the formation of young students from public schools. Took part in this project around 70 youngsters from the first year of high school. Two questionnaires were applied to the students, one before starting the research and another at the end, through which we could observe an excellent development of the students regarding the scientific concepts and school performance. Throughout the year practical activities were developed, with content related to daily life, always making usage of alternative materials and a booklet, which was developed to assist this project. The lessons were developed in their classroom. It can be assured that the practical lessons were crucial to the science teaching, because they enabled a better learning theory. The results were very promising towards the development and interest of students and teachers.
Keywords: teaching, science, practical lessons, learning, knowledge

Introduction

Currently it is quite common to find higher education students facing difficulties in the natural sciences areas, as a result of the decrease in the high school quality. This fact has become more evident when the Ministry of Education data about students' performance in 2011 was published, which shows that the students failure rate in this stage of education, both in public and private schools, was higher in the last 13 years.

It is believed that this difficulty is arising from the high school, where the traditional classes, composed only by theoretical lessons have not been sufficient to prepare students for the next steps.

In this sense the practical lessons are important for the knowledge building and reflection on their learning, but there are some barriers for its accomplishment. According to some reports (POSSOBOM et al, 2007), learning does not occur due to listening and fliping the notebook, rather by a theoretical practical relationship, in order not to compare, but to arouse interest to students, generating discussions and better use of lessons. According to Lima et al 2006, factors such as overcrowded classrooms, depreciation of the education professional, outdated physical structure, scholastic methodology and didactics, as well as family problems, limited access to textbooks and other sources of knowledge, as websites, interfere in the construction of knowledge.

This experimentation arose a few years ago and aims to improve the science learning process and it will be used for a subsequent application of its content. Through science one can better understand the world where we live in, once it is present in everything we do, we use and live.

The link between theory and practice is one of the major issues discussed in the initial and continuing training of science teachers. especially that based on the technical or academic rationality, from which it is understood that, to train the teacher, it is enough to base them theoretically as much about science to be taught as much about the pedagogical theory, and the teacher will be prepared for their practice, applying theory learned during graduation (SOUZA, 2011).

The practical lessons are of fundamental importance for students to associate the theory to practice and relate all this knowledge to their daily lives. The students' curiosity is aroused towards new

experiences. There could be no creativity without the curiosity that drives us and sets us patiently impatient before a world that we did not make, to add to it something of our own making (Freire, 1997).

Acoording to some authors (Castilho et al., 1999), the experiments are a tool for clarification, problematization and discussion of concepts with students.

In this sense it is noteworthy that laboratory and equipment are not required in order to conduct the practical lessons. It can be handled in the classroom itself. There are many resources and alternative materials that can be used, especially in the chemistry field. Then, the space does not become a barrier to the science teacher, although the short period of time is.

As long as there is an available room, suitable materials and the willingess to teach, you can move your knowledge onto youngsters from public schools. Freire (1997) used to say that "to understand the theory one needs to experience it." Thus, the practical lessons are fundamental to the science teaching at school and can be used to improve learning acquisition and the construction of scientific knowledge. These lessons can help in this interaction process and in the development of scientific concepts, in addition of allowing students to learn how to objectively approach their world and how to develop solutions to complex problems (LUNETTA, 1991).

This presented research aimed to assist in the improvement of the science learning process, especially in the chemical sector through workshops, collaborating with the youth education from public schools, preparing students with a different background of the current audience . It was developed in Prudente de Morais city, near Sete Lagoas city, in the state of Minas Gerais.

Methods

Aiming better development, a study of public high schools of Sete Lagoas region was carried out, selecting a school in the city of Prudente de Morais, Minas Gerais, town located 3 km from Sete Lagoas, due to its viability and ease of access, where was presented the project and complied with enthusiasm. The practical lessons were applied to the first year of high school, amounting a total of 70 students.

Initially a questionnaire was administered to students to check and diagnose their knowledge level regarding science and another at the end of the project, targeting to assess to what was learned throughout the project course along the year of 2015.

The workshops were conducted weekly, alternating classes and disciplines in order not to harm the content and education taught in class. There was a great support from the school management and the teachers who helped to select the schedules. These practical lessons were performed in the classroom itself often with assistance of a teacher and making use of alternative materials. Thus, the work count on with the collaboration of the entire school community, students, teachers of all areas, principals and staff.

In the workshops, activities related to science were developed, with an emphasis on chemistry, always seeking to show its importance in our life, group work, and always tied to theoretical content usually studied in the first year and when possible awakening them for coming years content.

A booklet was developed to assist the workshops consisting of experiments script as a guide for students. Each experiment contained: an introductory text on the subject to be discussed and its application in daily life, the goal, the materials to be used and how to perform the procedures. The researchers were constantly in touch with the teachers for guidance, with the concern of not disrupting the school calendar. Several themes were worked such as atom density, matter, mixtures, solubility, reactions, conductivity among others. In all the workshops there was a record by means of testimonials from students about the work carried out and some pictures, as another evaluation tool besides being the work feedback, in addition to the questionnaire.

Results and discussion

It is seen in public schools and even private that teachers reports are always the same: lack of resources, room and time to conduct practices ... This does not become setbacks, as it is worth even setting aside part of the theory that should be taught and then work out a practical lesson, than worrying only about the theory. It is evident that the return will be much greater.

To Krasilchik (2008), the classes are rather widespread due to the lack of time to prepare materials and also the lack of security in controlling the students. But may the teachers however after all recognize that the enthusiasm, interest and involvement of students compensate any teacher for the effort and the work overload that may result from practical lessons.

Diagnosis of teaching and learning is extremely important to analyze the weaknesses of elementary school and difficulties target audience carry. The questionnaire applied at the beginning of the work was of fundamental importance. In this first phase the questionnaire was answered by about 70 students. The questions carried out are described in Table 1.

Table 1: Questions of the first questionnarie applied to the students of the first year of the high school

First Questionnarie
1) What is science?
2) Do you study science ( ) YES ( )NO If so, what science?
3) Do you think science is part of your daily life? Support your answer
4) Do you think that science learning would contribuite to your daily life? Where?
5) What would be a practical laboratory in your opinion? What is it for? What is there?
6) What discipline do you most like? Why?
7) What discipline do you think is harder? Why?
8) Do you like chemistry? ( )YES ( ) NO Support your answer.
9) If you could choose your future career now, what would it be?
10) Write down a phrase with the words: water, soil and susteinability.

Based on the data collection it was possible to identify some difficulties and shortcomings of the students, as the discussions that follow. For the first investigative questions it was drawn the graph in figure 1.

The types of questions are listed on the x axis. Looking at it is possible to verify the students gap when regarding their knowledge and awareness related to science and laboratories. There are about 90% of respondents who study science, but many consider that science is just biology, or sometimes they were not able to identify that the disciplines studied are also from science field. A great part of the students, around 72%, like chemistry, although they found it a difficult and complicated subject. Regarding the question "Do you know what is a practical laboratory?", Many students said they know what it is, but most have never had contac with such lab, because the school does not have one.

After applying the initial questionnaire, it was diagnosed the necessity of a dynamic groups discussion in each class before starting the work. So, the first activity was a dynamic to demonstrate to the students the importance of teamwork and also show that it would be essential for the workshops along the year for the project development, and especially, not only at this point, but for everyday life. At this meeting the students were divided into teams and the goal was to assemble a puzzle. The team that gathered all the parts and assembled the puzzle in the fastest time would be the winner and win a prize. The image formed portrayed themes like water, Earth, life and experimentation. Some questions were asked to reach the dynamic purpose, for example, asking them why they won or lost. The teams who lost reported that lacked organization and collaboration of some members of the team, as the winning teams said they worked together and everybody made efforts, helping each other and these were the big steps to win the dynamics.

After dynamics, there was a discussion with the students to set the importance of teamwork. Calling their attention to the future life, which offers numerous competitions and group work, regardless the path that each individual wants to follow.

The workshops with topics related to daily life were:
Water dissolves almost everything: How do polar substances dissolve in water and non-polar substances do not;
Solubility of materials: How some materials have increased water solubility;
Building the volcano: Building up a volcano with clay, paint and styrofoam;
Volcano reaction: Putting a volcano to work using a chemical reaction;
Eyes on the cabbage: Concepts definition of acid and base and how to identify them through indicators;
Non-Newtonian Fluid: How do fluids behave according to the force applied to them;
Flame Test: How to identify elements by flame color;
Density: How to calculate, change the density and also compare different densities;
Conductivity and solubility: Ionic substances conduct electricity;
Liquid Layers: Miscibility of liquids, applying density and solubility concepts;
Violet that disappears: Color changing due to chemical reactions;
Soap powered boat: How to change the water surface tension.

At the end of the workshops the students showed being very interested, always questioning and relating what they have learned to other conditions and problems. They were amazed when seeing the color changes, lights and transformations that took place in the meetings.

The monitoring and recording of practical lessons by the students were of fundamental importance, so it was produced a booklet, figure 2.

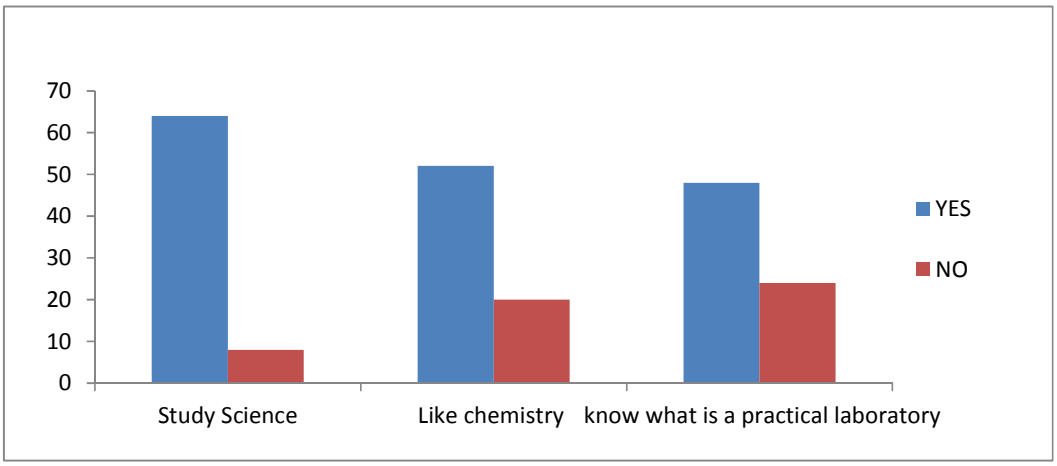

Figure 1 . Outcomes of the first investigative questions asked to the students

Figure 2. Booklet and one of the workshops

The meetings were astounding, facing the challenges of education and knowledge exchange. Below are students comments of the testimonials about some workshops.

In the workshop related to the solubility of materials and conductivity, the students were able to learn what and when solubility substances are soluble or insoluble. At the end, they themselves differed, without any difficulty, soluble and insoluble substances and why electricity conduction happens.

"It was great because we learned about conductivity of materials. Differs from the usual classes, because this is much more interesting."

For completing this workshop it was used Coke, water and saline solution to test the conductivity. Other substances were mixed to also show reactions concepts and physical and chemical phenomena, for example, by mixing colorless solutions of lead and iodide potassium acetate, resulted in the formation of a yellow solution, lead iodide. Students were delighted with such "magic" chemistry.

"It was very interesting, we were surprised with the lead acetate reaction with potassium iodide. It was very interesting. Loved it!"

"The project was really cool, today found it very interesting that the mixture formed the lead iodide, left the yellow and solid substance."

"I found it very interesting, I was surprised by the reactions of the experience. Very cool."

At this time it was performed the construction and reaction of the volcano and fluid non-Newtonian. The students loved to put their hand on the dough to model their own volcanoes and make a quicksand, and even learned concepts about reactions that they have already had contact, but had no idea what they in fact were.

"It's been a very nice experience. Learning new things about very interesting materials. I really enjoyed the volcano and quicksand experience . "

Students were always very anxous to attend the workshops, which was noticiable at the time of the experiment execution, when everyone wanted to perform the procedures. It is important to highlight the valuable help of the teachers in the room and students organization and students so that everything was always kept in order. Figure 3 shows parts of these moments.

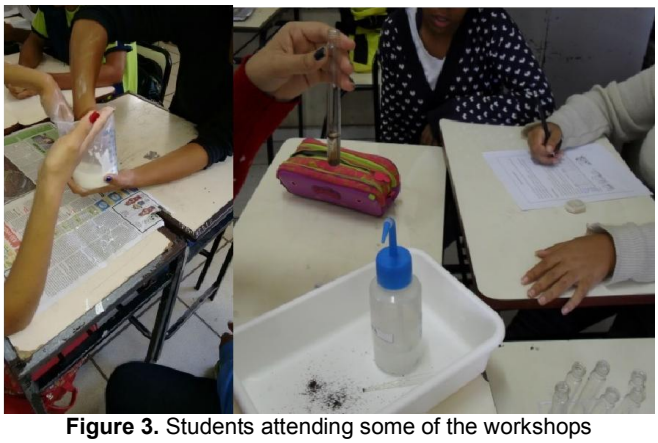

Figure 3. Students attending some of the workshops

However, it was apparent that a small part of the students were not very interested in joining the workshops, and when they accepted, they did not take it seriously, disturbing the concentration of their classmates. This is a major problem faced nowadays by all the education professionals.

According to another testimonials, students reported that it was a great opportunity to put into practice the theory seen in the classroom. These showed themselves always very interested and looking forward to future meetings, as can be seen below.

"I am enjoying the workshops a lot. Being able to have contact with all these experiments. It is really interesting."

"I am enjoying a lot, because we are practicing what we learned in chemistry and learning much more."
"The practical lesson workshop is being very interesting, as we have no laboratory it is being very interesting and cool. It is always good to know innovations. I'm really enjoying learning, the experiments are very cool.I hope the practical lessons continue up to the end of the year. "

According to the teachers, this work is of great importance for the students, as it arouses and brings the curiosity together and allows a better understanding of the subjects studied.

In order to conclude the work, the same questionnaire was applied with the addition of some questions, as illustrated in the table below. About 50 students responded to this final questionnaire, the number is considerably smaller, but some students were not present on this day.

Based on this last questionnaire it was possible to draw some graphs and realize the difference in the beginning of the works. The first of them was similar to figure 1, that were fundamental.

It was observed that in comparison with the previous one it was possible to infer some significant changes.

In this current investigation into whether "Study Science"; "Like Chemistry" "Think practical lessons are important", it was observed that most students also responded Study Science, but at this time there were more varied responses such as physics, chemistry, humanities, natural sciences and biology. Almost all students answered that science is present in their daily lives, food, medicine, environment, cosmetics. A percentage slightly higher of the students, about 80%, told they liked chemistry because they always discover some innovative thing and it has very interesting reactions, Figure 4.

According to the students, the project was very interesting because they had the opportunity to observe some of the concepts they had learned in the classroom in a more didactic way and also even relate them to the kitchen of their house where constantly happens chemical reactions. Furthermore they concluded being of such importance seeing some of these reactions and deepen in some chemical concepts.

Considering the question "Regarding your performance in chemistry,did the project help you?", About 93% of students answered yes, figure 5. The result of the student performance assessment after the works done can be seen in figure 6 and the students evaluation of the project in figure 7.

Table 2: Questions of the second questionnaire

Second Questionnaire
1) Do you study science? ( ) YES ( )NO If so, what science?
2) Do you think science is part of your daily life? Support your answer.
3) Do you think practical lessons are importante? ( )YES ( )NO Support your answer.
4) Do you think to be essencial to have a laboratory to the practical lessons? Justify.
5) Which area do you most identify with? Why?
6) Which area do you think is harder? Why?
7) Do you like chemistry? ( )YES ( ) NO Support your answer.
8) If you could choose your future career now, what would it be?
9) Regarding your performance in chemistry, did the project help you? ( )YES ( ) NO
10) What grade would you give to your post-project performance, 0 to 10?
11) What grade would you give to the project, 0 to 10?
12) What grade would you give to the students that developed the project, 0 to 10?
13) Write down the activities and workshops that you would like to attend.
14) Did this project help you with the studied concepts? Grade between 0 to 10.
15) Write down a short text with your opinion about the project.

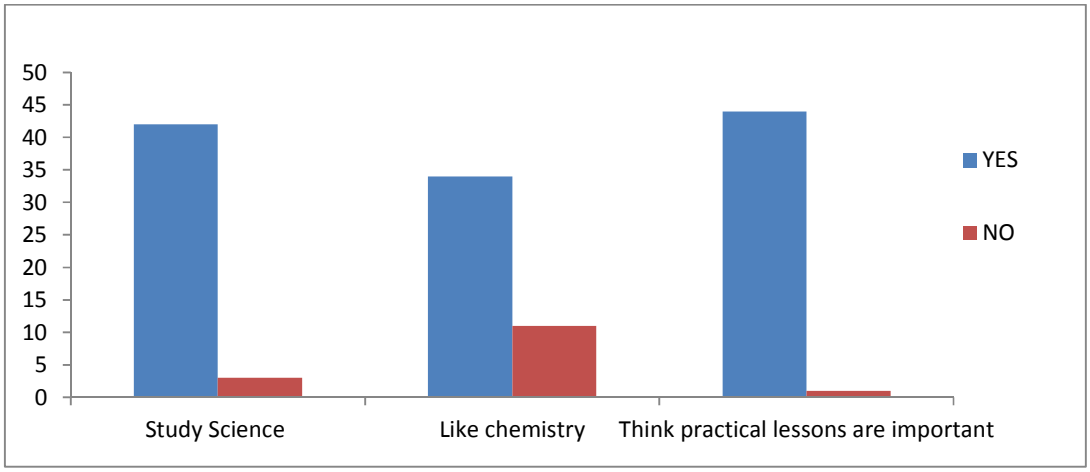

Figure 4. Some of the questions from the second questionnarie

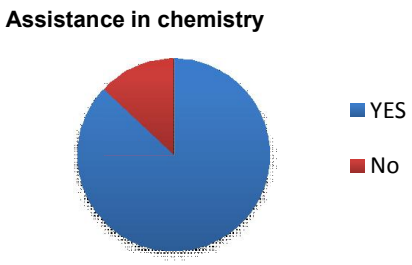

Figure 5. Students answers regarding assistance in chemistry

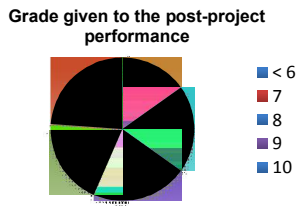

Figure 6. Grade given to the post-project performance

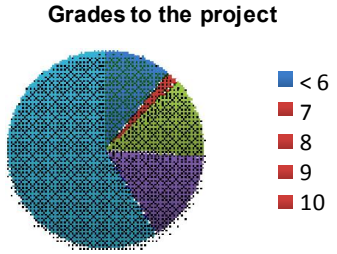

Figure 7. Grade given by the students to the project.

Practices should awaken in general a great interest in students, besides providing research investigative situation. These lessons when planned taking into consideration these factors, constitute particularly rich moments in the teaching-learning process (Delizoicov et al, 2000). This fact is evidenced when placing a comparison between the pre and post-completion results of the project, through which it is possible to observe an improvement of students over their performance and school participation.

According to Prigol and Giannotti (2008), the practical lessons are a way to assess, and assist in the teaching-learning process, since monitoring the learning process of students passes by the progress and classroom difficulties observation. It is an important activity that the teachers should do, as students often find it difficult to understand the content role of what they have studied in the classroom.

Conclusions

The practical lessons are a tool of crucial importance to the science teaching and to be achieved it is not necessary a specific local, as a laboratory. Taking into consideration all the time given to the tasks, it is only needed to insert in the classroom small science experiments that allow the knowledge and pratice association. Through the experimentation students will be enabled to develop autonomy, inquire and evaluate issues that bring them closer to everyday situations. The work was very promising for the whole school community and to the UFSJ, since it promoted interaction among the institutions, through students opinions, teachers and principals. Thus, the science teaching through practical lessons promotes interaction among students who experience different situations and do not get tied only to the traditional theory, being sujected to the everyday situations inquiry and sharpening their critical sense.

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