HOME EXPERIMENT AS A NEW WAY IN A BETTER ACQUISITION OF NATURAL SCIENCE KNOWLEDGE IN THE 9TH YEAR SCHOLAR SYSTEM

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Abstract

It is already known that the acquisition of natural science knowledge encounters a wide variety of difficulties. Very often, the abstract form of these subjects makes it necessary the use of demonstration or experiment for the pupils in certain science topics. However, there are many difficulties encountered in securing the basic lab materials in schools, which lead in searching new ways of teaching. This is the aim of this paper, the new and improved practical ways of teaching natural sciences, focusing in experiments from everyday life. It is recognized that many of the experiments or illustrations in natural science discipline can be obtained from the daily experience. Particularly, the home environment could be used as a source of a wide range of experiments, which are expected to increase the curiosity of the students and to create the possibility for fulfillment of the laboratory requirements as one of the most important components in natural science knowledge acquisition. Knowing the difficulties and problems in the implementation of lab home tasks, the use of everyday life and the variety in different areas of the country constitute the object of the paper presented. Dealing with student and teacher difficulties, as well as with the problems associated with parents and students in Albanian reality, is one of the main challenges in our educational system. Therefore, this paper suggests several ways on solving problems of this nature giving examples from the most advanced school systems. Suggestions are also given on how the scientific experiment as a home task could be used in better understanding of natural phenomena. This paper could be valuable for natural science teachers in 9th year scholar system for a better performance in their everyday work.

Key words: *demonstration, home experiment, security, laboratory*.

INTRODUCTION

Natural science education encounters a wide range of difficulties during the teaching process. Therefore, their teaching process cannot be thought without the practical component or the experiment, which should be very useful in the relationship between the theory and practice. The Albanian scholar system deals with a wide variety of textbooks (altertexts), which should provide the necessary theorical and practical information for the students. However, in most cases, the practical component is not fully addressed, because of the lack of the laboratories in schools, lack of necessary materials in the lab for particular practical works, or even the missing experience of the teacher in conducting the practical works themselves. Natural sciences, including chemistry, in most of the cases need demonstration or experiment for the explanation of certain topics.

The aim of the paper is the presentation of new and improved ways in teaching natural sciences, especially chemistry, based mainly in the practical work, and focusing in experiments from everyday life. It is recognized that many of the experiments or illustrations in natural science discipline can be obtained from the daily experience. Particularly, the home environment could be used as a source of a wide range of experiments, which are expected to increase the curiosity of the students and to create the possibility for fulfillment of the laboratory requirements as one of the most important components in natural science knowledge acquisition.

In order to fulfill the above aim, a detailed study of chemistry texts in Albania was performed. There is a wide variety of textbooks in use for the 9^{th} year scholar system, and therefore there is a wide range of choices that depend on many factors. Each of these textbooks was analyzed and then compared for the practical work and experiment they contain. This analysis focuses in the association of theorical concepts with practical work using the everyday materials. The results of this analysis leads to suggestions on how chemistry and natural sciences in general, could be related with everyday life and materials, and how practical homework could be a valuable tool for the acquisition of new concepts.

1. TEACHING PROCESS, ITS AIMS AND IMPORTANCE OF PRACTICAL WORK

There is a huge amount of scientific knowledge today. Consequently, it is necessary to be aware which attitudes, skills, and knowledge have to be demanded of today students. There are different levels of teaching goals, general headline goals, or educational goals, which cover all fields of education at school. However, the teaching goals should connect the content of the subject with the aspects of behavior. These latter have three dimensions (Moller 1973):

- Cognitive dimension, that covers perception, memory and thinking
- Affective dimension, that covers interest, attitude and values
- Phychomotoric dimension, that covers manual an physical skills

The teaching goals of cognitive dimension have been organized hierarchically with increasing complexity by Bloom (1972):

1.	Knowledge	Know concrete data, facts, rules, laws or symbols
2.	Comprehension	Connect facts, interpret and extrapolate data, derive conclusions
3.	Application	Use or transfer knowledge to new situations
4.	Analysis	Divide complex information, analyze data, recognize causal relations or patterns
5.	Synthesis	Put together single information to form a complex, coordinate data, think systematically
6.	Evaluation	Evaluate complex topics, draw conclusions

German experts suggest the following hierarchy (Bildungsrat 1971):

1.	Reproduction	Reproduce knowledge from memory
2.	Reorganization	Reorganize familiar knowledge for new situations
3.	Transfer	Transfer familiar knowledge to new topics
4.	Problem solving	Solve problems, find new explanations

However, it is difficult to assign isolated teaching goals to these levels. But it should be evaluated at the same time with the background of the students' and level of knowledge. Today teaching goals are focused on the actual reality of education, and its association with everyday life.

a. Lesson planning with reference to practical work

Chemical education provides preparation for those who are to conduct research in chemistry. But it can also provide a component of the general education. Whatever the purpose addressed, the chemical education must be based on a sound understanding of the chemistry itself. The difficulty remains the distinctive nature of the subject (Gilbert 2003). However, it is still very important to create a relationship between the theory and the practice during the teaching process, in order to maximize the acquisition of the new knowledge in class. From this point of view, the lesson planning plays a crucial role in the process and connects the teaching goals, the student's attitude, and the theory with the practice. During the planning process, the teacher should be able to fully answer the following questions about the practical work in class (Bonsch 1976):

- Which experiments are planned in the textbook and which alternatives are possible?
- How can the choice of experiment be explained?
- Are the experiments used according to their specific function?
- Is the experiment planned as a teacher, student or group experiment?
- Are necessary safety measures provided?

b. Importance of practical work

Natural sciences, including chemistry cannot be thought without their practical component. Therefore, laboratory works are an integral component of learning chemistry. Since the importance of natural sciences is growing the latest years it is accompanied with an increasing interest towards the practical or laboratory work. But still it is teachers' duty to determine the goals for the laboratory work, the students' goals for the same lab work, how students will reconstruct chemical understanding, how the instruments used in the lab influence the importance of the phenomenon (Nakhleh et al 2003). Many researchers believe that it is almost impossible to learn chemistry without performing an experiment or at least seeing performed an experiment (Foster 1929). DeBoer (1991) noted the potency of practical work in developing the critical thinking in class and laboratory in many cases became over time the central focus of science instruction. The focus is justified by the fact that natural sciences offer direct experience with natural phenomena of the word. Nowadays, the laboratory experience and the practical work has been universally regarded as essential, as necessary, fundamental and very valuable in the teaching process (Kirschner and Meester 1998; Thomas 1972; Blosser 1980, 1983). Moreover, practical and laboratory work allows students to learn with understanding and construct knowledge by doing science (Tobin 1990).

As abovementioned, the experimental or practical work is an important component of the teaching process, especially in chemistry. This activity clarifies the meaning of the theorical concept. Moreover, the teaching process becomes more active and focused on the student. The experimental encourages the involvement of the student in the practice and increases the acquisition of the new concepts in class.

Since the beginning of chemistry history experiment had a valuable role. It contributes in gaining scientific and empirical knowledge through experimental proofs of hypothesis under controlled and systematically modified conditions. It functions as a tool for the validation of hypothesis, running tests to describe substances and to compare special substances with other matter, to synthetize new substances not found in nature. The teacher should carefully plan, run and analyze experiments, and moreover the teacher should have the manual skills to handle equipment and chemicals appropriately (Barke 2012).

2. SCIENTIFIC CHEMISTRY AND EVERYDAY CHEMISTRY

Everyday chemistry works with substances. Everyday life oriented chemistry lessons focus chemistry lessons consistently on everyday life. However, even in this case scientific chemistry should serve only as the guideline for chemical education. From this point of view, chemistry helps students to acquire the scientific knowledge for explanation of everyday phenomena. The connections between chemical knowledge, technological advance and individual living habits can be presented and discussed in the historical view during the teaching process (Barke et al 2012).

Everyday chemistry includes all chemical processes and related substances that play a role in our life. Chemistry questions from everyday life should increase student curiosity and involvement in class. Issues to be considered during the planning process are (Barke et al 2012):

1. In which areas do the student have everyday life experience – home, kitchen, bathroom, garage, garden, etc
2. What kind of chemical phenomena do the students experience every day – burning paper, wood, coal, etc, or environmental problems

3. How can be encouraged the student critical thinking – chemistry relation with environmental issues

Some issues are more interesting for girls and others for boys. Consequently, strategies in chemistry teaching should be developed to combine everyday life with the meaningful learning. Some of the following teaching activities contribute in a better acquisition of the new knowledge and in creating the connections between chemistry as a science and everyday activities (Barke et al 2012):

1. Learning through active hands-on experimentation – analysis of river water
2. Field trips to places of interest – wastewater treatment plant
3. Presentation and discussions with special experts
4. Audio-visual media or multimedia – production of substances that cannot be seen near school
5. Project-based teaching or project-oriented lessons – water and environment
6. Topics without relations to everyday life – laws of chemistry, atom structure, etc
7. Topics with references to everyday life as initial motivation
8. Topics ending with references to everyday life for reinforcement
9. Topics full of references to everyday life
10. Curricula with full references to everyday life

a. Main problems of practical work in class

During our research, it was noticed that altertexts in use in our schools have a low number of experiments programmed which can be performed during the classes. This number varies from 0 experiments to 29 experiments per chapter, which means that there are chapters without any practical activity programmed. But the problem raised from the questionnaire conducted in 9^{th} level schools is that most of our schools lack the chemistry labs, which makes impossible the experimental work during the lesson. Another common issue related to practical work in class is the deficiency of specific laboratory materials for a specific topics or experiments. On the other hand, a number of teachers are not familiar with practical work and do not have the needed experience in performing the programmed experiments or replacing them with similar ones in accordance with the topic. As a consequence, the majority of the laboratory classes is not performed or is explained only theorically.

3. HOME PRACTICAL WORK AS AN ALTERNATIVE WAY FOR A BETTER ACQUISITION OF CHEMISTRY KNOWLEDGE

The focus of creative and active teaching should be the involvement of the students during the class, and therefore enhancing their critical thinking about various chemical phenomena. It has been shown that the practical performance of chemical phenomena increases the knowledge acquisition and students interest about the subject. Moreover, when the chemical phenomena are related to everyday activity, the result is much more satisfactory.

As abovementioned, the practical work in class, though essential in teaching process, faces many difficulties nowadays. Consequently, materials from everyday life could serve as a concrete source for practical experiments. In accordance with the topic, students could be assigned to perform the experiment at home by themselves. Some examples could be:

1. **Topic**: Ions and electric current

Materials needed: table salt, clear plastic vial, paper clips, battery, flashlight bulb and socket, insulated wires with alligator clips, water, coffee stirrers, and sugar. Students are asked to investigate the conductive properties of the ions in ionic substances.

2. **Topic**: Acids and bases
   Materials needed: lemon juice, red and blue litmus, blackberries, bowl, dinner fork, cups or glasses, red cabbages, non aluminum pot and cover, water, stove, refrigerator, white vinegar, household ammonia, substances for testing (apple juice, grapefruit, rubbing alcohol, powdered cleanser, salt and sugar solutions, aspirin, baking soda, citric acid, washing soda, tonic water, olive juice). Students are demanded to investigate the color of the litmus in each of the solutions prepared in house. So they judge if the solution is acid or basic, according to the theorical information taken in class.
3. **Topic**: PH
   Materials: pH paper with color scale, vinegar, small jars, water, household ammonia, powdered cleanser, baking soda, lemon juice, grape juice, washing soda, measuring cup, hydrochloric acid solution, sodium hydroxide solution. These are solutions, which can easily be found in the home environment. The student should focus in the color change of the pH paper.
4. **Topic**: Neutralization
   Materials needed: teaspoon, milk of magnesia, saucer, water, cabbage juice extract, eyedropper, and lemon juice, sink. By now, the students have the necessary knowledge about acids and bases. In this practical home work, they are demanded to conclude about the neutralization phenomenon. Practically, they should focus on the change of cabbage color during neutralization.

There are so many examples for home practical work. This is an alternative way of teaching practical chemistry. It is cheap and students are familiar with the materials needed for the home experiment. However, the teacher should be familiar with this type of practical work and should be able to assign the home work according to the topic discussed in class. This contributes in the connection of theory with practice and everyday life.

CONCLUSIONS AND SUGGESTIONS

There are a lot of difficulties related with the teaching process of natural sciences and chemistry in particular. Most of the schools in Albania lack the science and chemistry labs or the necessary materials to perform a specific experiment in class. Consequently, there is a need to find alternative ways in order to increase the knowledge acquisition. There is strong evidence through the questionnaires that topics with practical work/experiment demonstrated during the lesson have better concept acquisition.

Chemistry is strongly related with everyday life activities, and therefore the demonstration for chemical phenomena can be easily found in the surrounding environment. Chemistry teachers should encourage students to develop chemical experiments as homework in accordance with special topics, which cannot be demonstrated or performed during the lesson Moreover, chemistry teachers should be involved frequently in activities in order to improve their practical skills, as well as to put them across their students. Future teachers need to be familiar with the compilation of chemicals, safety rules, as well as with the adequate disposal of chemical waste.

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