

## **Chemistry Lesson**

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During the school years 2015-16 and 2016-17 and within the framework of the European Programme KA2 “We can do it Together”, 56 students of the 11<sup>th</sup> grade at the 2<sup>nd</sup> Experimental Lyceum of Athens, were motivated to work collaboratively, adopting the philosophy of the peer learning, in order to improve their skills and consequently achieve better grades.

According to the greek curriculum, Chemistry at Lyceum is a general education lesson until the last 12<sup>th</sup> grade, where only the students that will take chemistry exams as a prerequisite for university entry, attend the lesson. Thus, many students at the 10<sup>th</sup> and 11<sup>th</sup> grade with seem to have decreased interest and skills in chemistry.

Students joined the program with pleasure, since it seemed to them interesting and challenging. All 27 students of each class were divided in groups of three: one with a good background and skills, considered to be the ‘mentor, a second with interest in science but minor abilities to complete a chemical project and another with complete lack of interest, insufficient knowledge of the topic and difficulties in maths or even practical calculations.

The fields we were involved were according to the curriculum, the following:

- (a) stoichiometry applied to chemical research or simple industrial problem solving
- (b) guided experimental design and application using lab worksheets

The worksheets were created to motivate interest, provide fun – as much as possible- and cultivate inquiry based learning. The basic aim was to give students the opportunity to collaborate and get benefits from each other, benefits appealing to their way of thinking, setting up a procedure, proposing a solution to the given problem and finally achieving good marks. It was clear to the partners of the group that they would all be evaluated as a whole, at the same time that their roles were well defined. Moreover the mentor aimed to his/her partners’ skills improvement.

The topics used were:

1. Petroleum, petroleum products
2. Fuels and biofuels

3. Atmospheric pollution
4. Alcohols: Alcoholic fermentation and reactions of alcohols.
5. Organic chemical reactions leading to industrial product synthesis.

A few examples are given:

### **1. Stoichiometry and limiting reactants in chemical equations**

Students are given the recipe for a cake.: 2 cups flour, 1 cup of sugar, 1,5 cup oil and 4 eggs. Assuming that they have at home 1 kg from each species (flour, sugar, olive oil) and 2 eggs, and given mass / cup content ratio for each one, they are asked to prepare the maximum quantity of cake, calculating the quantity of each ingredient to be used.

### **2. Fuels**

Assuming that a heater functioning with a known mixture of propane and butane is burning continuously for 10 hours in an isolated room and considering the fuel consumption in g/hour, students should calculate the percentage of oxygen in the room air, after the 10 hours heater burning.

### **3. Organic reactions: (product identification, synthesis, reaction yield)**

- a. Students practice on identification of products during chemical processes. They design the proper experiment they perform it and evaluate the result.
- b. Students are called to design an alcoholic fermentation experiment, perform it, distill the produced alcohol and calculate the yield of fermentation.

The results at the end of the year were encouraging! Students that had never before shown interest in chemistry, were actively involved in above projects and ...in a few cases they dared to take the role of mentor in a similar next project. Mentors had tried hard to make others understand and involve them actively and for this purpose in some cases they had to process concepts and overcome their own misunderstandings. Increased self-confidence and positive attitude towards chemistry and class activities was also a great benefit of this peer learning method. A 85% of them improved their final grades and finally the chem lesson in 11<sup>th</sup> grade appeared less boring and confusing.