

## Best Practices Using Ipad as a Teaching Tool Learning Chemistry

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### Abstract

The use of new technologies becomes increasingly and more relevant role in Science learning. The practice with personal computers has passed to being experienced in virtual environments and social networks. But with the emergence of mobile technology in education, a new change has occurred. The portability of such devices opens many possibilities in the learning methodologies and gives easily access to information. In this paper we describe and evaluate two activities carried out with the iPad as a learning tool. The activities were developed with 35 students at 1st course of Upgrade School from an educational centre of Granada. While the first group of them used an app for molecular structures visualization and interactive applets available on internet, the second group experimented with early gas laws. The results show that the use of these learning tools along with appropriated methodological approaches can promote on students meaningful learning.

### 1. Introduction

As a result from the weak points in science learning and the swift technological development of our society, the use of new technologies has increasingly more widespread and its role in education has become such as a usual research [9]. In addition with the already-daily use of computers in education, in the last years started some successfully experiences with new ICT tools as virtual environments [1] and social networks [8] [5]. Most experts agree that the implementation of ICT in the teaching of Sciences favours learning procedures and the development of intellectual skills even though it contributes to the training of teachers. Furthermore, it facilitates the communication among students and teachers, and allows their participation in projects from different backgrounds, simulating phenomena hard to observe in the classroom and assists students to build concepts and explanations [3].

With the initiation of mobile technologies in the classroom (especially iPad and tablets) a revolution takes place to manage the learning environments. The portability of these tools allows its uses in every place at any moment and has also the possibility to create virtual meetings which open windows to unknown universes and simulators able to give access such as learning laboratories for students. Many studies reflect more motivation and compromise from students who learn with ICT tools instead of those ones who just use the computer, even though also ICT give more distractions, probably because its newness [7]. Although, the main goal of this technology depends on the opener of the teachers and its application in the daily practice, that's why is necessary to investigate the main reason to explain the acceptance or unacceptance among teachers [6].

ICT are important tools in due to engage students to learn but are still a role to work with and put in consideration how to implement it in the daily learning practices. It is crucial to be aware of the important differences appeared in the knowledge acquired do not depend only in the tool or practice used for but to the pedagogical sense that apply on it [10]. So, is not sufficient to implement them in the traditional learning paths. If we really want to develop all its potential it is compulsory to make change directly in the teaching and learning methodologies, the activities at the classroom and the roles played by teacher and students [4]. Some of those methodologies, as the collaborative learning based on project development, are increased its efficiency with the ICT applications, that is possible with the creation of new communication and virtual environments and the exchange of data. However this success is required to have specified orientations, concrete objectives, relatively short time and clearly criteria to evaluate them [2]. Is fair for pupils to receive a complete scientific learning which take into account all the resources from the background, even though the suggestions is to try meticulously those resources and to have a strong and reflected teaching schedule [3].

## 2. Using IPad in Chemistry lessons

### 2.1 Work environment description

At our educational centre was implemented the IPad in the classroom during the academic year 2013-2014 at 1<sup>st</sup> course of Upgrade School.. Even more, pupils had Wi-Fi connection allowed to check complementary information and to have open access to the iCloud to exchange information immediately, both necessary for the correct development of the lessons.

Pupils had also digital text books through the educative platform *blinklearning*, which gives access to the digital versions of the current used books. The main achievement of this platform is that, once the acquisition of the license for the book is taken, the book and its contents are available without internet connection. Though the innovative format, digital and electronic books are not very dissimilar compared with the paper version used in previous academic courses, so we did not observe any significant change respect to the complementary material and interactivity.

The uses of digital screen was appeared few years before so the IPad as an educative tool has not been any innovation referred to images visualization, video playing, research of contextualized information and it uses as a supportive method within teacher explanations. What is a novelty for us is in it uses for cooperative learning activities with chemistry apps acquired by the Centre and chemistry applets available on internet. Two of those activities are described and evaluated proximately with a 35 students' group from Chemistry and Physics from 1<sup>st</sup> course of Upgrade School.

### 2.2 Working with a molecular visualization app.

One of the apps that students work with it is called *3D Molecules Edit&Drill*, a simple application permitted to create organic and inorganic molecules and its 3D structure visualization (Image 1)

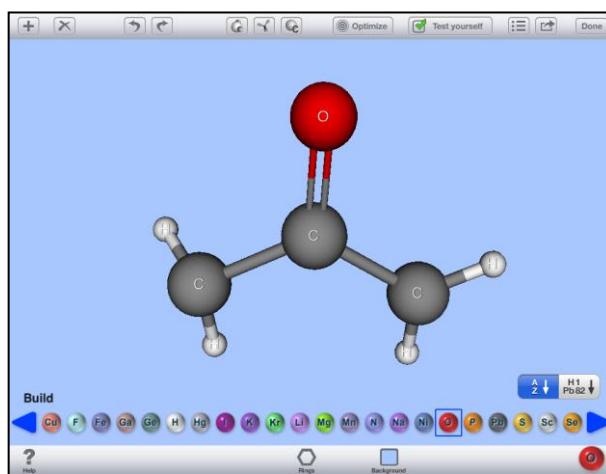


Image1. Screen capture of the app *3D Molecules Edit&Drill*.

When the unit for carbon chemistry ends, the students download this app to their dispositivo and they learn to use the program. Once the students used this app easily, they realized an activity divided into 4 sessions of 1 hour duration each. In the two first sessions the students were distributed in small groups, for 2-3 students, and they elaborated models in 3D of organic molecules based on their previous knowledge. At the end of each session, the work done was uploaded in a shared folder in Google Drive. In the two next sessions, they put in common with discussion among students the weak points and to make changes in the data collected on the folder and to add more new components remarkable for the students.

The results obtained with this application were very positive. It was possible to collect 3D models from 130 molecules (39 hydrocarbons, 71 oxygen-containing hydrocarbons and 20 nitrogenous hydrocarbons) and the 70% of the pupils who participate had positive qualifications during the exercise.

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In a questionnaire realized with the participating students, the activity had a positive value for the 80% of the students and the experience was qualified as "motivating". Among the positive aspects mentioned by the students, is reasonable to highlight: the doubts were correctly explained and increased the understanding of how to construct hydrocarbons with double and triple bonds, oxygen and nitrogen compounds and the concepts related to the structure of some molecules, such us isomers.

### 2.3 Working with on-line simulator

Another educational open resource evaluated during this academic course was the applets available for free on internet. The applets are tools which simulate physic and chemistry processes, and the most ones available on internet are in Flash program and is permitted the modification of its parameters in order to observe the changes made and to take conclusions from the experience. In our case, we used simulators elaborated in Flash about kinetic theory of gases and the early gas laws (Boyle's Law, Charles' Law and Gay-Lussac's Law).

The websites searched to develop this activity were:

- Interactive initiation to matter (Image 2, left side) suggested as a Spanish resource in the Chemistry is all Around Network project portal, available on internet:  
[http://concurso.cnice.mec.es/cnice2005/93\\_iniciacion\\_interactiva\\_materia/curso/materiales/indice.htm](http://concurso.cnice.mec.es/cnice2005/93_iniciacion_interactiva_materia/curso/materiales/indice.htm)
- Gases laws, and animation from la Junta de Andalucía with concretely explanations about Boyle, Charles and Gay Lussac laws, available on internet:  
[http://www.juntadeandalucia.es/averroes/recursos\\_informaticos/andared02/leyes\\_gases/](http://www.juntadeandalucia.es/averroes/recursos_informaticos/andared02/leyes_gases/)
- Interactive animations of Physics and Chemistry (Image 2, right side) an interactive animation available in English about Boyle and Charles gases laws from the gases kinetic theory.  
[http://www.physics-chemistry-interactive-flash-animation.com/matter\\_interactive.htm](http://www.physics-chemistry-interactive-flash-animation.com/matter_interactive.htm)

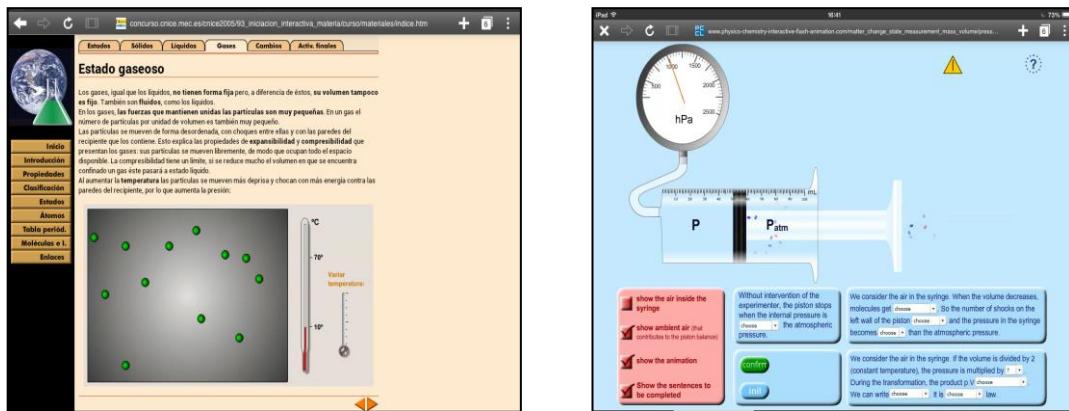


Image 2: Screen captures of the examples (a) y (c)

he uses with these applications replaced the paper books during the development of the unit contents, concerning to the kinetic theory and early gas laws. The application (a) worked to visualize one model of the matter states from a microscopically point of view and the second application (b) was used to show the kinetic theory of gases and early gas laws.

This applications were used during two sessions of 1 hour each, with a first lecture and visualization accompanied with a discussion in due to put in common the more relevant aspects of the lesson and to understand the doubts about the exercise. Finally, the application (c) was used during a 1 hour session left as a laboratory simulating practice with small students groups of 2-3 pupils each.

To evaluate the effectiveness of this methodology based on ICT applications, the contents from the knowledge acquired by this technology and the contents explained by using textbook were compared. It has been done by introducing a conceptual question about kinetic theory and early gas laws (ICT question) in one of the evaluation tests realized by the students and another question with the same structure about the contents teach following the traditional methodologies (control question).

Each question was evaluated with the following letters: A excellent answer (more than the 75% of the total amount qualification of the question), B acceptable answer (about the 75% and the 50% of the total amount qualification of the question) and C for an incorrect answer (less than the 50% of the total amount qualification of the question). The results obtained are showed in the double entrance table enclosed (Table 1):

		ICT question			
		A	B	C	Total
Control question	A	8 (22,86%)	5 (14,29%)	1 (2,86%)	14 (40%)
	B	3 (8,57%)	5 (14,29%)	4 (11,43%)	12 (34,29%)
	C	4 (11,43%)	3 (8,57%)	2 (5,71%)	9 (25,71%)
	Total	15 (42,86%)	13 (37,14%)	7 (20%)	

Table1: Double entrance table for qualifications obtained

In the table is represented the number of pupils who obtained each qualification (A,B or C) in the control question, situated along the rows and the number of pupils who obtained each qualification (A,B or C) in the ICT question along the columns. The diagonal between AA-BB-CC shows the students that obtained similar results in both questions. The pupils situated on the top of this diagonal, are those who answer better the control question rather than the ICT question, and those who are at the bottom are the students with better qualifications for the TIC question than the control one.

Analysing the results obtained, we observe the following points:

Despite of the results are similar above and under the diagonal line, we can observe a major quantity of answers A and B (80%) for the ICT question instead of answers with the same qualification for the control question (74,29%), it shows globally that the understanding of the ICT question has been higher than the control question. Furthermore, the concordance between the ICT question and the control question for satisfactory evaluations are more significant compared to its differences (pupils with AA are about 22,86%, while the pupils with AC and CA taken together account for 14,28 %).

With the data defined we can conclude that the students obtained higher qualifications in the contents learnt by the methodological approach based on ICT.

### 3. Conclusions

The use of simulators of experiences online increases the realization of laboratory practices when this is not available physically. The programs that show in details the matter structures at microscopically level or the representations of scientific models transform the classroom in an open educational environment that allows the closeness between concepts and scientific procurements. The easily access to information and its availability on internet (news, scientific blogs etc) bring the opportunity for students to incorporate it in their daily lives.

The introduction of IPad in the teaching of sciences, allows not only the personal work but also to work in small groups, it facilitates the exchange of data and open the discussion about the work done in the classroom. The obtained results give us the challenge to think about the fact that the correct use of technologies applied in the scientific learning, increases students' motivation. However, the exclusive use of expositive methodologies does not guarantee the total exploitation of this technological tool. If they are applied, in the appropriate environment which increments learning by research and the cooperative learning, it will promote on students meaningful learning.

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