

THE CASE STUDY ON THE IMPACT OF VIRTUAL LABORATORY EXPERIMENTS ON VOCATIONAL SCHOOL LEARNERS

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ABSTRACT

Through employing the Virtual Lab (www.ntse-nanotech.eu) at the web-site designed with a view to achieving this as well as the lesson plans which are inquiry-based lesson plans with reflections of Nano Technology in Science Education Ref. 511787-LLP-1-2010-1-TR-KA3-KA3MP, courses in which students actively participated were given. In the experiment room the teachers can watch teachers guide first in order to implement an experiment with their students <http://vlab.ntse-nanotech.eu/NanoVirtualLab/experimentroom/list?page=1&size=5>.

INTRODUCTION

According to E.G. Rocard Report (2007) there is an alarming decline in young people's interest for key science studies and mathematics. Despite the numerous projects and actions that are being implemented to reverse this trend, the signs of improvement are still modest. Reluctance of the students to learn science, rote learning and traditional teaching approaches and the lack of supportive and powerful educational materials advancing science education can be shown as the main reasons. The current initiatives in Europe actively pursuing the renewal of science education through "inquiry based" methods show great promise but are not of the scale to bring about substantial impact, and are not able to exploit fully the potential European level support for dissemination and integration (Science Education Now: a Renewed Pedagogy for the Future of Europe, European Commission, 2007). Therefore, the education of science needs to be renovated and enhanced with the new science technology and computer technology (NTSE Concept Paper, 2010).

SCHOOL PROFILE

Ceyhun Biliciler Anatolia Hotel and Tourism Vocational High School is located in the Ceyhan district of Adana. There are 180 students studying in our school for the academic years of 2013-2014. 30 of those are female, and 150 are male students. The 9th and 10th grades are comprised of only two branches. One of the classrooms is the accommodation and travel, while the other is the food and beverage department. The 11th grades have 3 branches; the 1st is the front office services, the 2nd is

the floor services, and 3rd is the kitchen department. The 12th grades also comprise of 3 branches. 2 of these are kitchen, and one is the service department.

WORK GROUP

The application has been carried out with 15 students as of 9th class 1st semester. 3 of them are females, and 12 are males. However, at the beginning of the second semester, 3 of these students dropped out of school, therefore the study was maintained with 1 student. 2 of those are females, and 10 are males. The application was carried out over the students of the department. Throughout the application, particular sections and activities of the below mentioned 7 experiments in the Virtual Laboratory have been carried out within a 3-week period as 16-hour long applications.

METHOD

In this study, the lesson plans entitled "Understanding Nanotechnology", "Making Origami Buckyballs", "Nanocrystal Fabrication", "Lotus Effect", "Iron Nanoparticles and Ferrofluids", "Waves and Dancing Ferrofluid, and "LEDs", which are inquiry-based lesson plans with questionnaires of Nano Technology in Science Education, courses in which students actively participated were given for 3 weeks. Pre and post test designed was conducted. The results of the questionnaire were analyzed according to the frequency of the answers. The results were identified and explained with the clustered bars.

EMPIRIC PROCEDURE

Empiric procedure is explained in a timely fashion below.

1. While planning the education, integration of inquiry based learning, improving digital and science literacy drawn out in scope of the NTSE project have been taken into consideration and each activity aims to gain these competences.
2. The week before the commencement of the implementation of the empiric process, the project expert has met the test group students and informed them on the implementation and tried to motivate them to willingly participate.
3. Before the implementation of the experiments, the access to the virtual laboratory and the sections were introduced.
4. Two hours of lesson were dedicated for virtual and hands on activities.
5. Each activity was done in groups of 3 or 5 to engage the students into active learning process.
6. The virtual laboratory implementations were conducted through following the steps of the

teacher guide of the Nanocrystal Fabrication experiment integrating the steps of Inquiry Based Learning as in the following;

- First teachers played the video about the “Nanocrystal Fabrication” in movie section,
 - Before opening the simulation about the “solution”, the teacher prepares a solution of hot water and sugar to recall their previous knowledge about the solubility, solutions and dissolution. The teacher provides monitoring of the process of the formation of nanocrystals.
 - Later visited the simulations and played them in the order of the four simulations (dissolution, molecular dissolution, precipitation, molecular precipitation) in interaction section.
 - “Sugar Cubes” and “toothpick” activities were conducted by following the Teachers’ Guideline. By conducting the hcp structure template activity in the NTSE KIT, they are enabled to acknowledge the crystal structure of the solid substances.– substance and its properties in chemistry and physics.
7. The “Power of Ten” video in the “Understanding Nanoscale” experiment is viewed. The Nanoscale Ruler activity is conducted. Measuring length in nanometers is written in scientific notation – exponential numbers in mathematics. Measuring length is converted from nanometer to centimeter – measurement in physics.
 8. In the “Making Origami Buckyballs” experiment, primarily the origami video is watched, and the buckyball activity in the NTSE KIT is performed. This activity is about one of buckball’s characteristics, that is the bonding of the carbon atoms with the covalent bonding. - Covalent bonding in chemistry.
 9. In the “Lotus Effect” experiment, the “Hydrophobic Paper”, and “Lotus Effect” videos are viewed, The “Hydrofobic Textile”, and “Magic Sand” activities in the NTSE KIT are performed. The Textile and sand here do not like water (hate water), that is they are hydrophobic – hydrofobic and hydrophile in chemistry and physics.
 10. In the “Iron Nanoparticle and Ferrofluids” experiment, the “Iron Nanoparticle”, and “Ferrofluids” videos are viewed. The “Ferrofluid” activity in the NTSE KIT is performed. It is observed that the ferroluid is magnetized when approached by a magnet and then the interaction of the iron dust with the magnet is observed. - magnetism in physics.

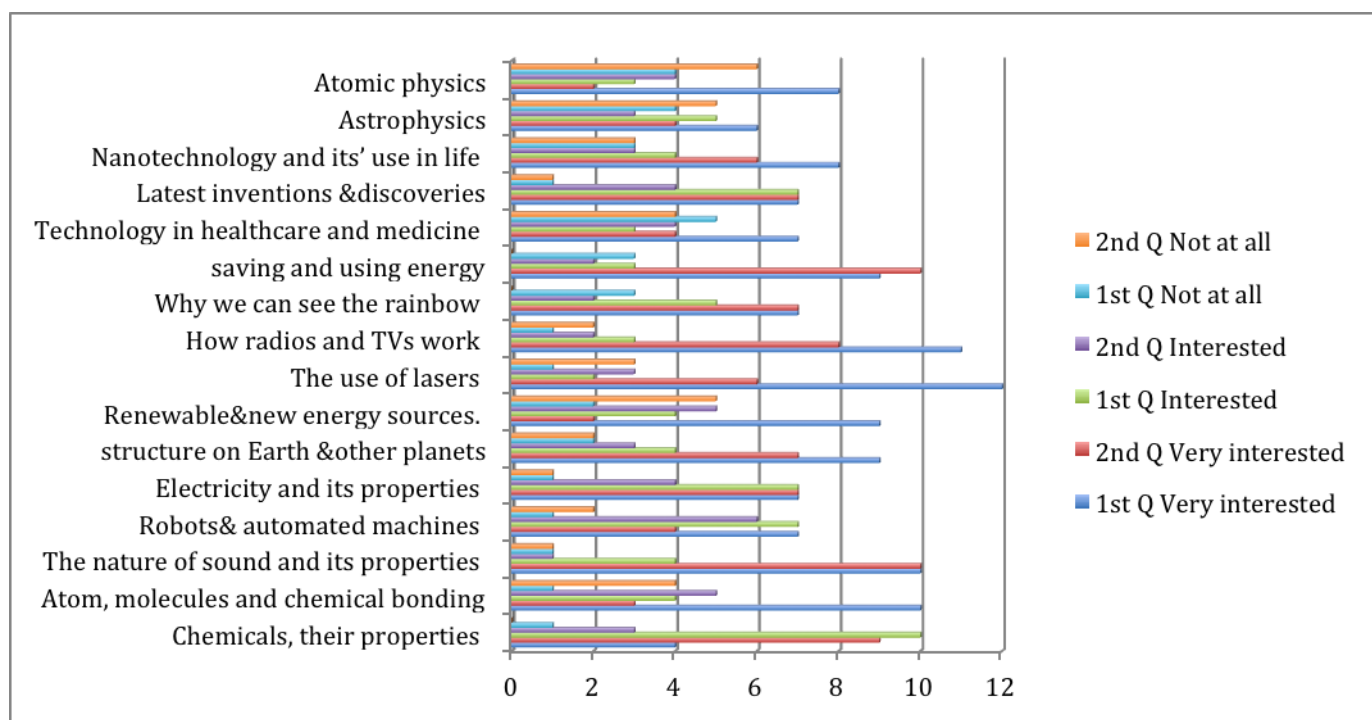
11. In the “Waves and Dancing Ferrofluid” experiment the “Dancing Ferrofluid” simulation is viewed. The relationship between voltage and ferrofluid is discussed. - magnetism in physics.
12. “Colors”, “Current”, and “Energy and Wavelength” videos in the “LEDs” experiment are viewed. The LED Strip activity in the NTSE KIT is conducted. The structure of the LEDs are examined – the nature of physics in physics.

FINDINGS AND COMMENTS

The survey results are presented on the same table as the first and second test results, and interpreted together with the clustered bar tables. The results are analyzed based on the frequency of the results.

Table 1.

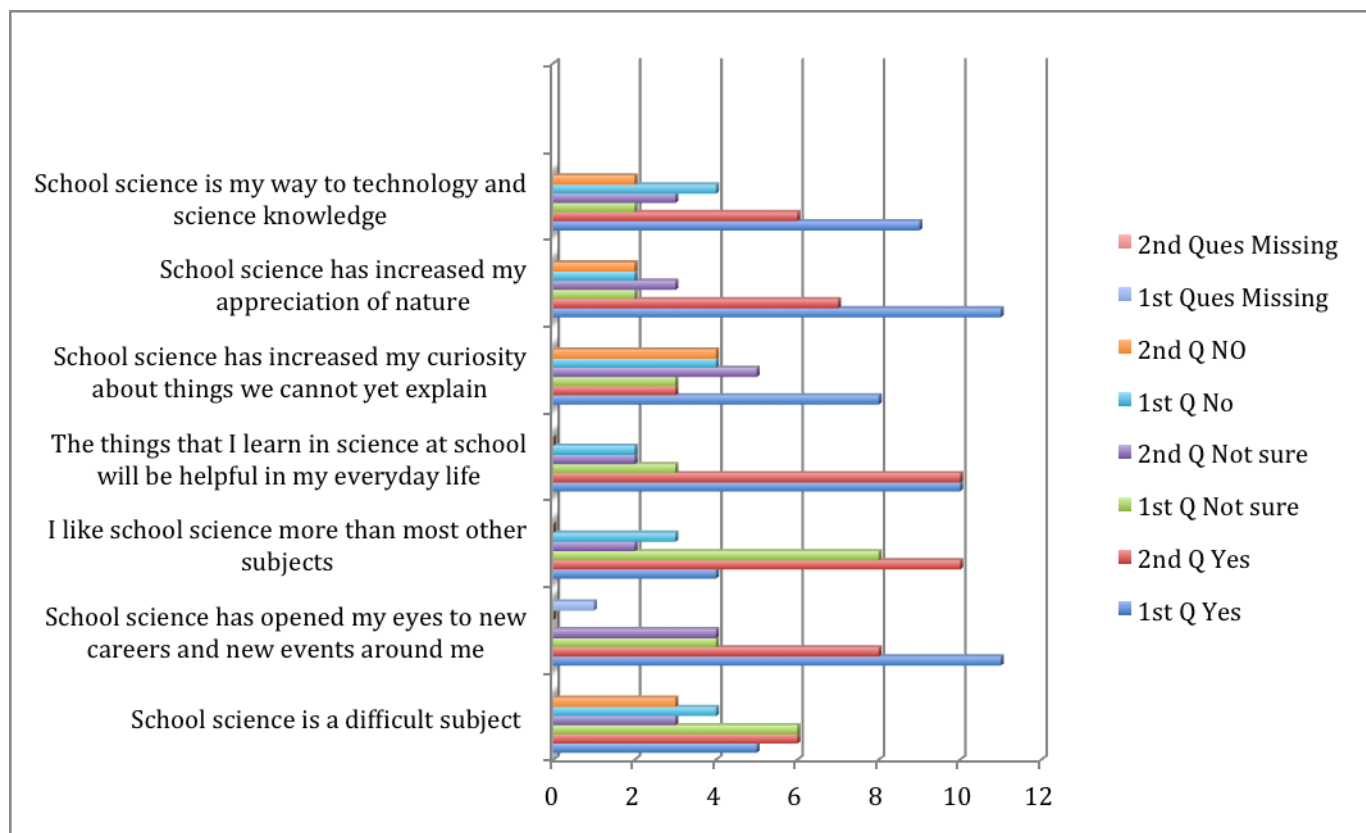
The pre-test and post-test frequency values regarding the question: **“How interested would you be to learn the below-mentioned science topics in your science classes?”**



In Table 1, the very interested topics “the nature of sound & its properties” and “saving and use of energy” stay the same. Apart from these topics, significant differences are seen in the topic “how the radios and TVs work” changes after classroom implementation. The popular topic, the differences in student answers have appeared especially in the topic chemicals and their properties is the popular in the 1st and 2nd questionnaires.

Table 2.

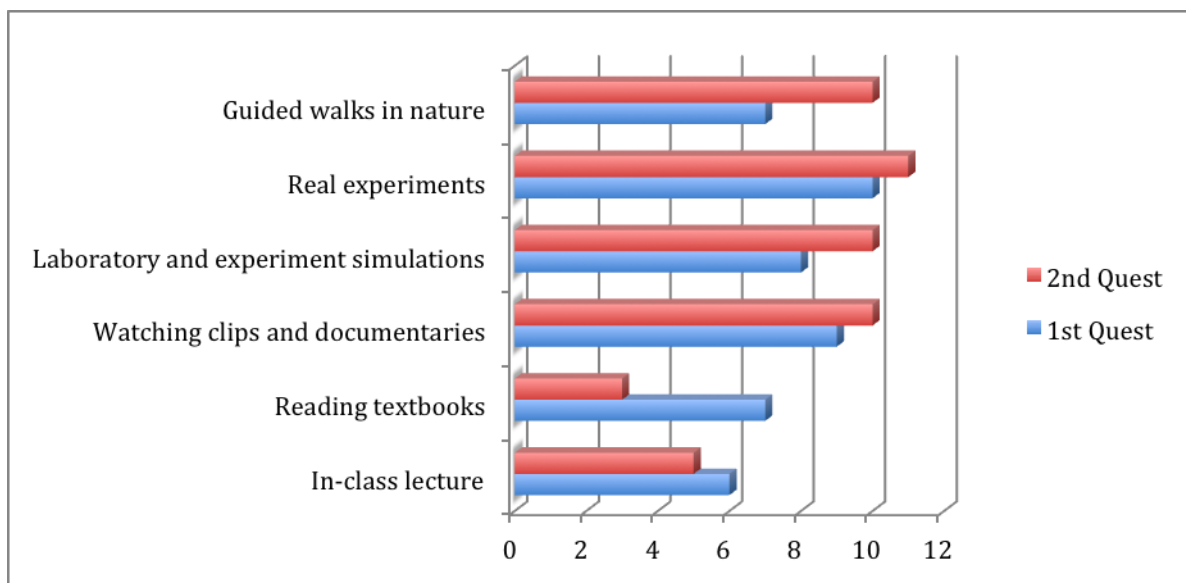
The pre-test and post-test frequency values regarding the question: **“What do you think about the science education at school?”**



According to Table 2, the only significant difference between student answers before and after the application appeared in the items “I like school science more than most other subjects”. In the 1st questionnaire it was 4 than it increased 10. It is more than 50% increase. These result shows that the applications conducted had a significant effect on their attitudes and opinions about the science classes at school.

Table 3.

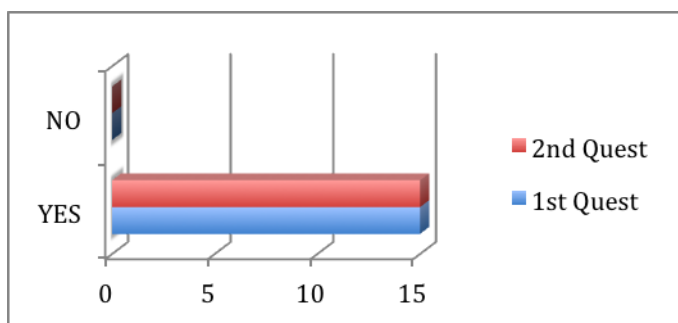
The pre-test and post-test frequency values regarding the question: **“according to me, the best ways to learn more on science and technology”**



According to Table 3, the only significant difference between student answers before and after the application appeared in the item “reading text book”. According to the pre-test, 7 students stated that the best way to learn in science and technology is to have lectures in the classroom. On the other hand, 4 students showed an attitude change in the post-test with the item guided walks in the nature. The other items are in favor of the pre-test.

Table 4.

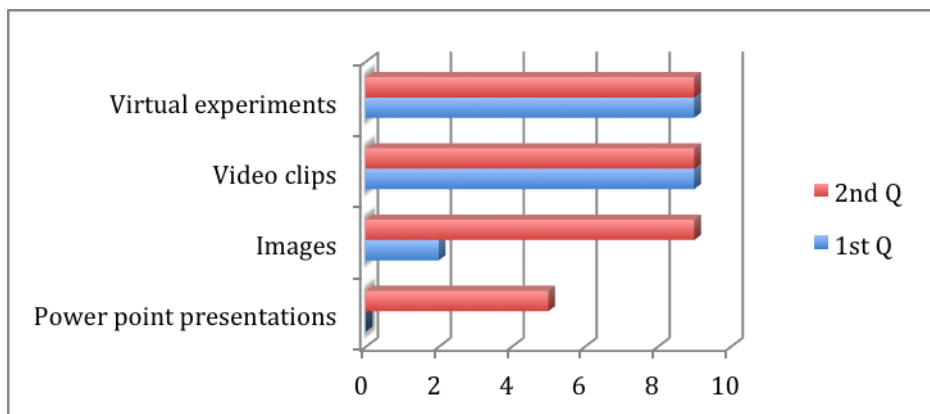
The pre-test and post-test frequency values regarding the question: **“Would you prefer learning facts on scientific topics on the computer and on the Internet?”**



According to Table 4, the answers to the question “Would you prefer learning facts on scientific topics on the computer and on the Internet?” have resulted with the same results. In pre & post test all students said YES.

Table 5.

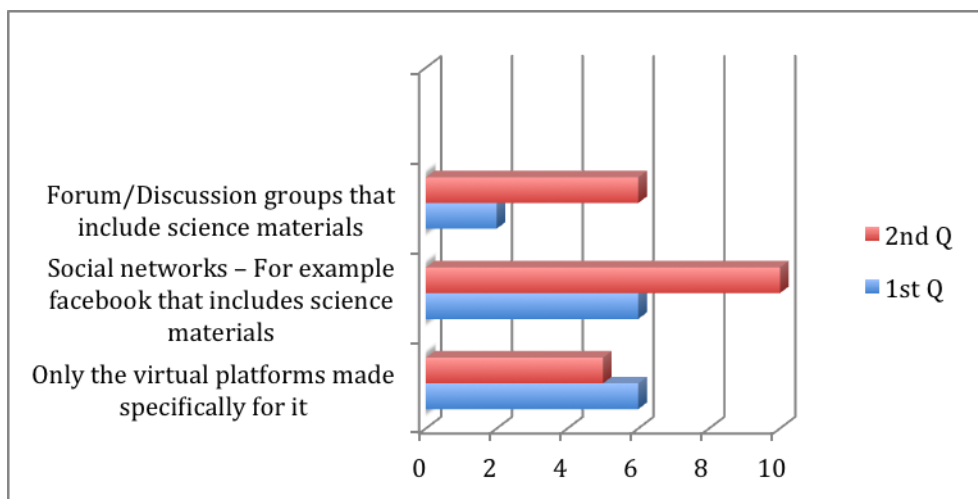
If your answer is “Yes” please define which devices you would prefer to use:



According to Table 5, highly selected items virtual experiments and video clips are the same. However the number of power point presentations and images increased after classroom implementation.

Table 6.

The pre-test and post-test frequency values regarding the question: “Which virtual platforms would you prefer to use in order to get more information about scientific topics?”



According to Table 6, there is meaningful and significant difference between the pre-application and post-application answers for the question “Which virtual platforms would you prefer to use in order to get more information about scientific topics?“. The item, Social networks – for example facebook

that includes science materials, was selected by 6 students before the application, the number of students who selected this item went up to 10 after the application.

CONCLUSION

At the end of the 3-week application conducted on the 9th, 10th grade students of the Ceyhun Biliciler Anatolia Hotel and Tourism Vocational High School, it is observed that the students' interest in the science education is increased, and they developed positive attitudes. However, it is also acknowledged that the applications and activities related to the 7 experiments within such a short period of time have worn out the students and they had hard times comprehending certain topics. In the next application, it will be appropriate to conduct each experiment as they correspond to the topics covered in the high school curriculum, and within a longer period of time.