

# AN EXAMPLE OF COMPUTER-BASED REMOTE SCIENCE'S LABORATORY

\*Mr.sci. Fehmi SKENDER, page 64-73

September, 2016; 1 (1)

## ABSTRACT

The Computer Aided Education Today, the advancement of technology and the increasing importance given to education, to solve the difficulties and problems, have become compulsory in order to take advantage of the technological possibilities.

The computer is one of the technological possibilities, the century in which we live is one of the fundamental elements of culture.

Today computers have become an unavoidable fact of recognition.

Indeed, recognition of the computer, a modern man, why are numbers such as literacy activities.

On the other hand, recently, software that may change the complete experimental training course have been created that can be good alternative for the school science labs in many rural areas, primary schools, secondary and higher education levels.

The number of students in the virtual classroom can vary according to the needs.

We have prepared student software that can be used for comfortable and easy participation in a virtual experimental course.

**Key words:** distance learning, virtual classrooms, science labs and remote Internet Protocol



\*Mr.sci. Fehmi SKENDER

International Vision University,  
Gostivar, Republic of Macedonia

**e-mail:**

[fehmi.skender@vizyon.edu.mk](mailto:fehmi.skender@vizyon.edu.mk)

**Article type:**

1.02 General scientific articles

**UDK:** 37.018.43:004.78]:061.64

**Date of received:**

Maj 26, 2016

**Date of acceptance:**

July 20, 2016

**Declaration of interest:**

The author reported no conflict of interest related to this article.

## 1. INTRODUCTION

Remote Science laboratory research is based on computer aided education history. In the late 1950s in the U.S., in advanced universities such as Stanford and Illinois, computers were used for administrative purposes. In the 1960s and 1970s, with the introduction of lower cost computers, projects related to educational applications started to be developed. The most important of these projects are the IBM 1500, PLATO and TICCIT systems. The IBM 1500 project at Florida State University taught computer-aided physics and statistics teaching at the university level, and later, in the mid-1960s, the promotion of reading and math skills. The PLATO, which can be considered as the first comprehensive project on the use of computers in education, was conducted by the University of Illinois in cooperation with Control Data Corporation. With the impact of these projects in the United States, in the 1970s, computer-assisted instruction was recorded in England, France and Germany. The “Micro-Electronic Training Program” set in England in 1980 and the “100,000 Computer” target in France in 1983 and the launch of the “Information for All” program in 1985 on short- The introduction of computer training to the upper echelons of secondary education, and subsequent dissemination to the lower echelons are examples of these developments, of course they can be said to be remote science laboratories. Recently, remote science laboratory projects have been developed on different platforms and such studies are of great importance. While we have been using our remote science laboratory in physics experimental courses, we have made it an alternative of practical experimental laboratories. Of course our work here will not end.

Remote Science laboratory research is based on computer aided education history. In the late 1950s in the U.S., in advanced universities such as Stanford and Illinois, computers were used for administrative purposes. In the 1960s and 1970s, with the introduction of low cost computers, started development of projects related to educational applications. The most important of these projects are the IBM 1500, PLATO and TICCIT systems. Computer-aided physics, as well as statistics were taught at Florida State University in the frame of IBM 1500 project. Later, computer were used for promotion of reading and math skills. The PLATO, which can be considered as the first comprehensive project on the use of computers in education, was conducted by the University of Illinois in cooperation with Control Data Corporation. Initiated by these projects in the United States, in the 1970s, computer-assisted instructions were restarted in

England, France and Germany. The “Micro-Electronic Training Program” set in England in 1980 and the “100,000 Computer” targeted in France in 1983 and the launch of the “Information for All” program in 1985 are introduction of computer training into upper secondary education. Also, subsequent dissemination to the lower secondary education are examples of these developments and they can be considered as remote science laboratories. Recently, remote science laboratory projects have been developed on different platforms and such studies are of great importance. While we have been using our remote science laboratory in physics experimental courses, we have made it an alternative of practical experimental laboratories. Of course our work does not end here.

## **2. CONCEPTUALLY AND METHODOLOGICALLY DETERMINATION**

Use of Computer Assisted Education has started as consequence of increased need for education, increased number of students and amount of information, complication of teachable contents and importance of personal education. Significant steps are being taken to implement remote education and science laboratories as well as the computer and internet used in the ordinary education process. First of all, the simulations used in science lessons are considered to be the starting point. Modern remote science labs require both well-crafted software and a daunting daemon. If experiments are being carried out at a certain time at a laboratory in Macedonia and any other school in the world, then other students from a number of various geographically remote places can participate in the experiments interactively.

### **a. Distance education and definition of remote science laboratories**

The distance education program and the science laboratory are software-hardware system that conduct education by linking the student with the educational resources. The fact that distance education programs provide education opportunities for persons who are not enrolled in or registered to any educational institution, indicates that the number of education opportunities that have recently been recognized as students is increasing.

Another aspect of the remote science lab is that it makes good use of available resources and it has to follow up fast developing technology.

With the help of computers and electronic devices, the delivery of the training to the distant students or the experimentation is really regarded as a training point. It is important to note that electronic tools are a major contributor to this training program, stating that the teacher and the student are geographically remote from each other.

The most simple definition of remote experimental training is that the instructor and the students do not share the same time frame without sharing the same physical environment. In some programmed education-teaching-learning activities are carried out within the scope of a certain program through the employment of technological tools.

#### **b. Remote Science Lab's Aim**

The most important aim of the remote science laboratory model is to bring the activities to a large mass of students, regardless of distance and time. This remote laboratory type offered to the trainee facilitated training with flexibility. In addition, the majority of tests and tests that are repeated after multiple repetitions (even after the end of the experiment) increase the efficiency of this training. In short, remote science experiments are complete solution for schools that do not have science laboratories. The level and the quality of the knowledge that can be mastered with courses that include remote science labs can easily be found to be very close to the ones obtained with courses that include real experiments and practice. That, on the other hand is higher level and quality than the traditional courses can offer.

#### **c. Remote abuse and disadvantages of science lab**

The benefits of the remote science lab can be summarized as follows:

- Information can be sent to the whole world from the center of the laboratory,
- Student motivation is high because there is no time limit
- Allows the learner to study from where one wants, the learning distance is reduced, one can participate in the experiments.
- Virtual laboratory facilities for schools experiencing financial difficulties for the establishment of school laboratories.

The disadvantages of the remote science lab are:

- Lack of face-to-face interaction that is important in learning environment.

The communication problems that can be caused by the excessive number of students can be listed as disadvantages such as low quality internet connection or not having enough computers.

**d. Establishment of remote science lab**

The quality of contemporary education is directly proportional to the intensive theoretical knowledge as well as the transfer of practical knowledge based on visibility. Supporting the theoretical knowledge given in primary, secondary and higher education education with practical information for practical purposes increases the permanence of the transferred information and shortens the training period. The transfer of information on the application is also directly proportional to the facilities of the university, equipment and facilities and their adequacy according to time and place. Thanks to the development of internet and software technology, the restrictions imposed by the application possibilities can be prevented and training can be done quickly and with high quality by turning it into an independent space and place.

**e. Hardware and software support of remote science lab.**

It is possible that this can be realized by using different techniques in a multi-field environment, interacting with the remote laboratory. For such a project, multimedia is designed in the form of contemporary WEB design programs that take Hyper Text Markup Language (HTML) or that as a basis. Prepared WEB hypertext means that a section of a text can be accessed from another text. The recalled text may be a section of text within a WEB, or a part of text on any machine on the network. Briefly create a hyperlink or link. Two different structures can be used during the remote science laboratory realization phase. While the first structure is server-oriented in relation to the client and the server, there is a distributed orientation in the second structure, in particular in our research it is necessary to use certain protocols for video conference support. Server and user computers also need certain basic software for software. Hardware devices are needed primarily for effective remote laboratory operation. Initially the server then needs to set up the internet topology and protocols connecting the user and:

- 64 its, RTTP (Real Time Transfer Protokol) destekli, Quade-Core 2.6GHz, 80,1935,9123 TCP and 16.384-32.768 UDP.
- 100 Mbits/sec.simetric data tranfering 500 GB HDD.
- WEBCAM 320x240, 640x480, 1280x720 and speed: 0,25Mbits/sec; 0,40Mbits/sec; 0,60Mbits/ sec.
- Connection to server VOIP conn. And sped:0.04 Mbits/sec .• DualCore processor and 2 GB RAM User PC with 60 GB HDD and multimedia supported (microfon,speackers & WEBCAM ).

Remote science lab requires software support after hardware support. It offers opportunity to open an account for any server operating system from the server Windows or Linux family, Windows 7 or higher version, Linux Edubuntu or higher version, Mac OS / 2, Java platform, GoogleChrome or Mozila FireFox, software. Compositor software and hardware enable the creation of virtual classes and simultaneous presentation of remote science experiments. In order to determine the benefits of the remote science lab, three classes of 25 people were randomly set. Classes were investigated as follows: control class followed by experimental training - experimental class followed by remote science laboratory - remote science laboratory class followed by classical education.

### 3. RESULTS AND COMMENTS

The research includes:

- Experimental method
- Comparative method

The investigated sample in this experiment consisted of 25 classes from geographically remote cities randomly selected. They were divided into control sample of students, which followed traditional lecture and experimental sample of students, which followed experimental activities and remote science laboratory.

Preknowledge test related to the course content was conducted for both samples, control and experimental, in order to obtain the base line of knowledge. This helped to compare the results from both samples

The preliminary information test consists of 10 questions and is applied to each class student. The questions are related to the lesson to be built. 25 students in a class have a total of  $25 \times 10 = 250$  questions. Answer key:

Table 1. The preliminary information test

Class	TRUE	FALSE	WITHOUT ANSWER	Trues
Control	225	20	5	90%
Experimentaly	221	28	1	88.4%
Remote lab's class	226	14	10	90.4%

As one can see from the table, the students show almost the same success in the preliminary information test. So students who will participate in verbal, experimental, and remote laboratory lessons have about the equal information potential as the classes. One week after the preliminary information test, physics was taught by experienced instructors at the same time. So each class has taught different instructors. While only classical lessons were given for the first - control class, the education methods and study techniques were applied.

The second-experimental class was carried out in the same classroom physics lab. Following the necessary information and presentations, experiments were carried out on practical lessons.

From the third-remote lab group, remote and experimental experiments were conducted.

Lessons were conducted at the same time, while the instructor for the third group taught remotly, from the university laboratiry, 150 km away from the school.

The remote science lab group students first opened their accounts using the remote science laboratory services to the WEB site, and then each student contributed to the course through their computer.

Simultaneously, the video conferencing service provided seamless communication, video interviews, conversations, or messages to 25 peop-

le. Of course, the lecturer can remotely recognize or silence his students as speakers. Presentations or tests prepared during the lesson can be shown or transmitted.

The remote science laboratory program interface had the opportunity to offer all the necessary facilities for the course. The execution of the program was in the hands of the instructor, but the interaction-assisted software was unable to communicate in every way without problems. Remote science laboratory software consisting of simple elements is easy to use and flexible.

After the lesson was given, all the students were again subjected to the test prepared for the course. Just 10 questions were given to each class.

The test time lasted 45 minutes, the results were different:

*Table2. Post test*

<b>Class</b>	<b>TRUE</b>	<b>FALSE</b>	<b>W I T - H O U T ANSWER</b>	<b>Trues</b>
<b>Control</b>	<b>156</b>	<b>62</b>	<b>32</b>	<b>62.4%</b>
<b>Experimentaly</b>	<b>211</b>	<b>33</b>	<b>6</b>	<b>84.4%</b>
<b>Remote lab's class</b>	<b>205</b>	<b>32</b>	<b>13</b>	<b>82.0%</b>

Experiments applied to the real classroom and the same environment students in the science sciences always lead to better classroom success.

**1. Control**

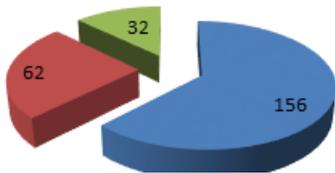


Diagram 1. Control Unit

**2. Experimentally Unit**

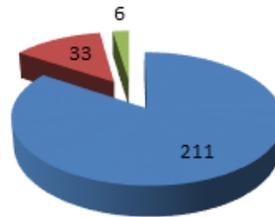


Diagram 2. Experimentally Unit

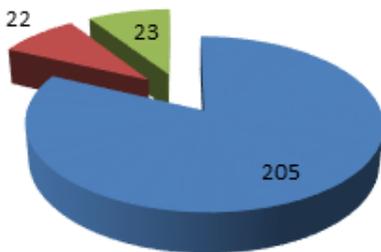
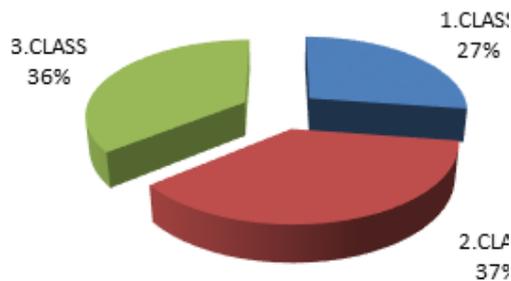


Diagram 3. Remote Unit

**GENERAL**



**4. CONCLUSION**

Three grade students had success after lesson. While the students participating in the classical training course showed the least success, the remote laboratory group approached the success of the actual experiment. With the method of comparison, the obtained results are very near to the initial hypothesis.

An interactive virtual classroom and a remote virtual laboratory sample application were introduced, removing time and space constraints. It is hoped that such a practice would be a positive step towards reducing the failures resulting from the ignorance of classroom and individual characteristics and accumulation in non-formal education.

It is improving the attractiveness and development of distance experimental education, which is the solution to the transportation problem from

distant places, the opportunity equalization in education, the opportunity to give chance to those who have not been educated or left for various reasons, the use of economic time without disturbing the life course and helping students to realize education alone.

The remote science lab is a model that differs from standard training models in terms of implementation. It is an educational activity where students, teachers and educational tools in different places are brought together through communication technologies. While real-world experiments for students and faculty are more productive and more practical, remote science labs are a complete alteration for all remaining situations.

## 5. BIBLIOGRAPHY

1. Cohen, Luis. *Research Methods in Education*. Edition 7. Routledge-2011.
2. Denscombe, Martin. *The Good research Guide*. Edition 5. Open University Press-2014.
3. Şimşiek, Canan Laçın. *Fen Öğretiminde Okul Dışı Öğrenme ortamları*. İstanbul 2011.
4. <http://www.jret.org/FileUpload/ds217232/File/uzaktanegitim.pdf>
5. Belanger, France and Dianne H. Jordan. *Evaluation and implementation of distance learning: technologies, tools, and techniques*, Hershey, PA: Idea Group Pub., 2000
6. Brooks, David W. *Web-Teaching : A Guide to Designing Interactive Teaching for the World Wide Web (Innovations in Science Education and Technology)*, 1997
7. Chute, Alan G., and Melody Thompson, Burton Hancock. *The McGraw-Hill Handbook of Distance Learning: A "How to Get Started Guide" for Trainers and Human Resources Professionals*. McGraw-Hill, 1998 (ISBN: 0070120285)
8. Cole, Robert A., ed. *Issues in Web-based pedagogy: a critical primer*, Westport, Conn.: Greenwood Press, 2000
9. Collis, Betty and Jef Moonen. *Flexible learning in a digital world: experiences and expectations*, London: Kogan Page, 2001
10. Dede, Christopher. *The evolution of distance learning : technology-mediated interactive learning : a report for the study, "Technologies for learning at a distance," Science, Education, and Transportation Program, Office of Technology Assessment, Congress of the United States, Washington, D.C., 1989.*