Impact of computer simulation on evolution of applied and educational researches

[1]Hatem Musa , [2] Muhammad Mahmoud Mohsen

[1]Head of Computer Department, College of Education, University of Tobruk, Libya, [2] Department of Biomedical Technology, Faculty of Medical Technology, University of Tobruk, Libya

Abstract:....

Recently, there have been many means and techniques for teaching physics, and they have been classified into different types of auxiliary methods that simulate the real laboratory and work to bring the researcher's imagination closer to visualizing some difficult physical theories. And software development experts rely on data, laws of physics, and initial principles to create a virtual environment for conducting experiments, in which all conditions and parameters corresponding to the real laboratory are available .It is noted that the researcher's interest and appreciation for the universality of science and the way to treat it in practice It is almost non-existent. Because science represents the simplest and most difficult experiences of everyday life, so It can be argued that learning science should be a natural or automatic consequence of something related in a prescribed manner. However, in many cases, neither the curriculum nor the textbooks reflect the science Common denominators and the importance of science. Too often, learning is often reduced to researcher passivity

While becoming the supervising professor - like the one who puts knowledge in the empty space .In order to deal with this situation, we must return to the basic principles

constructivism, which advocates the use of prior knowledge to understand new explorations, Thus, the researcher is able to build his knowledge through the synthesis of cumulative experiences, past and present. And so constantly we will find that experienced researcher Not prepared to delve into abstract concepts and connections related to science topics And the instructions on which it is based, and laboratory tests

are often presented and are dependent on previous information and the sciences that are considered the basis for it and that he needs .

A concrete inquiry-based process that is not only important for fostering interest, but also for proving the importance of a scientific topic and solving a specific problem .

The purpose of this study is to draw attention to the importance of these conceptual changes, which effectively contributed to Understanding Physics Experiments

In this paper we used a simulated laboratory application (PhET) and a practical laboratory application (HLE) in the Faculty of Science and the Faculty of Education, University of Tobruk, Libya .

. 1 Introduction:

Engineering majors are a vital part of the economy of countries, and the most important of them are professions filled with unqualified graduates. To solve this employment gap, it was necessary to improve and enhance STEM education, particularly in the preparatory years of university education .Various methods have been used in practical colleges, such as Revising curricula, evaluating science, technology, engineering and mathematics, increasing the use of technology and demanding funding for research and studies .In-depth study of basic engineering science, conducting a practical graduation project, etc ..To meet this need, educational courses and educational programs have been approved Computer simulation These courses include concepts of learning by performing labs and designing and creating models With the increasing use of simulation effectively, these procedures have become essential in applied sciences, as they are considered an addition to Laboratory experiences assisting the researcher .

This was the prevailing view of the scholars It is the use of simulation in the close observation of experimental phenomena to identify and collect data in order to support

New theories, and the researcher should engage in similar activities to prepare himself in order to be able to raise his efficiency and perform his scientific tasks better .

Nowadays, careful focus has been placed on laboratory experiments because of their importance It offers important benefits that directly affect the material output of research and scientific studies .

The use of practical tools and devices, and programmed simulation techniques during data collection, contribute to building models that are similar to reality, and such treatments work to confirm the validity of the theories and hypotheses on which they are

based .Simulation laboratories have contributed to helping students and researchers for a deeper understanding that can help the effective use of the practical laboratory and thus acquire additional skills and necessary experience, exchange information and ideas, and transfer theoretical knowledge .

into practical applications [1]. The hands-on lab helps develop innovation and critical thinking skills. It may be a motive to know the materials and equipment used in the laboratories and work to find the ideal methods in preparing and preparing for realistic experiments, and this is what enhances the researcher's confidence and confirms the work steps .Many studies have shown that practical activities help the researcher to excel in performance And follow the traditional scripts [2-8] Also, it enhances information and replaces misknowledge in scientific concepts [9]. Which is considered to develop positive attitudes towards science [10-14] and encourage talent .

Creativity in solving specific scientific problems, enhancing the independence of researchers, and improving their skills in scientific research that requires good induction, accurate calculations, and serious communication (6,15) .

.2 Methodology:

Researchers need to conduct experiments because they allow them to apply theoretical concepts by dealing with devices, equipment, and data, and to build and enhance knowledge and skills, which will have a vital and influential role in the future [16]. These knowledge and competencies can be developed not only in traditional laboratories (hands-on), but also using computer simulations and remote laboratories. These online resources in addition to allowing the researcher to practice some experimental skills activities in a different way, is an incentive for the younger generations of digital researchers [17]. Of course, these researchers should be aware that they are getting different experimental results from these resources: real results from remote labs rather than computational model results from simulations. A “hybrid” or “hybrid” approach to laboratory learning—a combination of hands-on labs, simulations, and remote laboratories—appears to be the most effective [3]. In addition to the use of cross-cutting techniques and resources, it may allow the supervising expert to reach more researchers [4]. Remote labs combine the advantages of both hands-on labs and simulations and are defined as an educational resource where the user and tools are physically separate. Communication between them is done using the Internet and user interaction with the tester (configuration, control and/or monitoring of results) is achieved through a computer or smartphone interface [5]. PhET (Virtual Machine Systems in Reality) is the most widely used electrical and electronic circuits laboratory.

And since 2015, it has been the best remote controlled laboratory .It contains the capabilities of controlling the parameters and values, with the same tools and components available in the real lab (22.)By addressing this topic, we hope to create similar simulation systems at the University of Tobruk, which will raise the level of study and the efficiency of higher education outputs (HEI), and also contribute to the convergence of the level of postgraduate studies in five different countries (23 .)

Our main goal is to provide the researcher at the University of Tobruk with contextual approaches (through electrical circuit analysis). In fact, we as experts already have this desire/interest in technology that creates interesting mechanisms for transmitting information to the researcher being a more productive approach to learning and exploring science and concepts [24,25]. On the other hand, the physics course contains a unit for analyzing electricity and electrical circuits, so we decided to use this simulation program to prove the relationship between the software technology and compare the results from it with the remote laboratory, which works to develop experimental skills and competencies as supported by many authors [26], [27], [28]. While collecting data from the program implementation results, an important gap was identified between the researcher's understanding of simulations and remote laboratories. In order to describe and analyze the specific problem, we described the environment of the experiment that was conducted, including the equipment, instrumentation parameters used, and other resources with great focus on the activity involving PhET .

. 3 Practical applications to find the difference between simulation and remote laboratories:

In this realistic experiment, we connect the circuit as shown in the figure to obtain the resistance (R) of a specific wire (resistance coil) according to Ohm's law

$$\frac{V}{I} = \mathrm{R}$$

Where, V: the potential difference between the ends of the selected resistance coil. (conductor)

I: the intensity of the current flowing through it .

If L is the length of the resistance wire, then the resistance per 1cm of wire

=R/L

voltmeter range

3 =v

Ammeter range

500 =mA

Lowest voltmeter reading

0.05 =v

Lowest reading of the ammeter

10 =mA

Zero error in ammeter reading

e1 = 0

Zero error in the voltmeter reading

e2 = 0

Table of ammeter and voltmeter readings:

Sr.No	Ammeter Reading I(A)		Voltmeter Reading V(v)		V/I=R
	Observed	Value	Observed	Value	
1	50	500 mA	16	16*0.05=0.8	1.6Ω
2	35	350mA	11	0.55	1.57Ω
3	32	320mA	10	0.50	1.56Ω
4	19	190mA	6	0.30	1.58Ω
5	10	100mA	3	0.15	1.5Ω

Mean R=1.56

The average resistance is

R = 1.56

The practical measure of the length of the resistance wire used in the experiment is: 28 cm

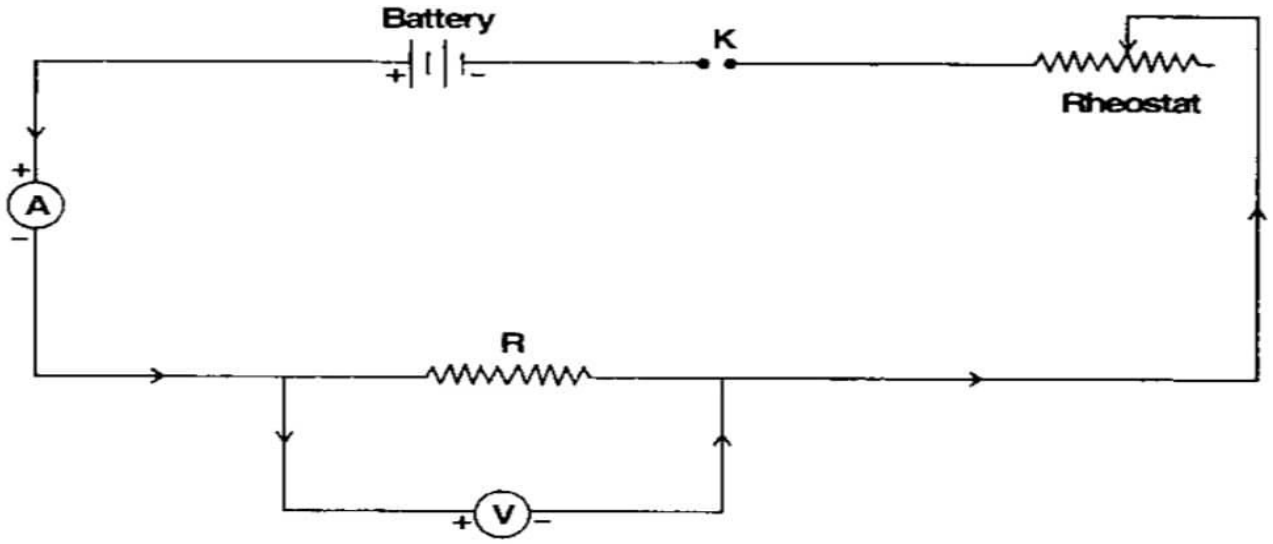
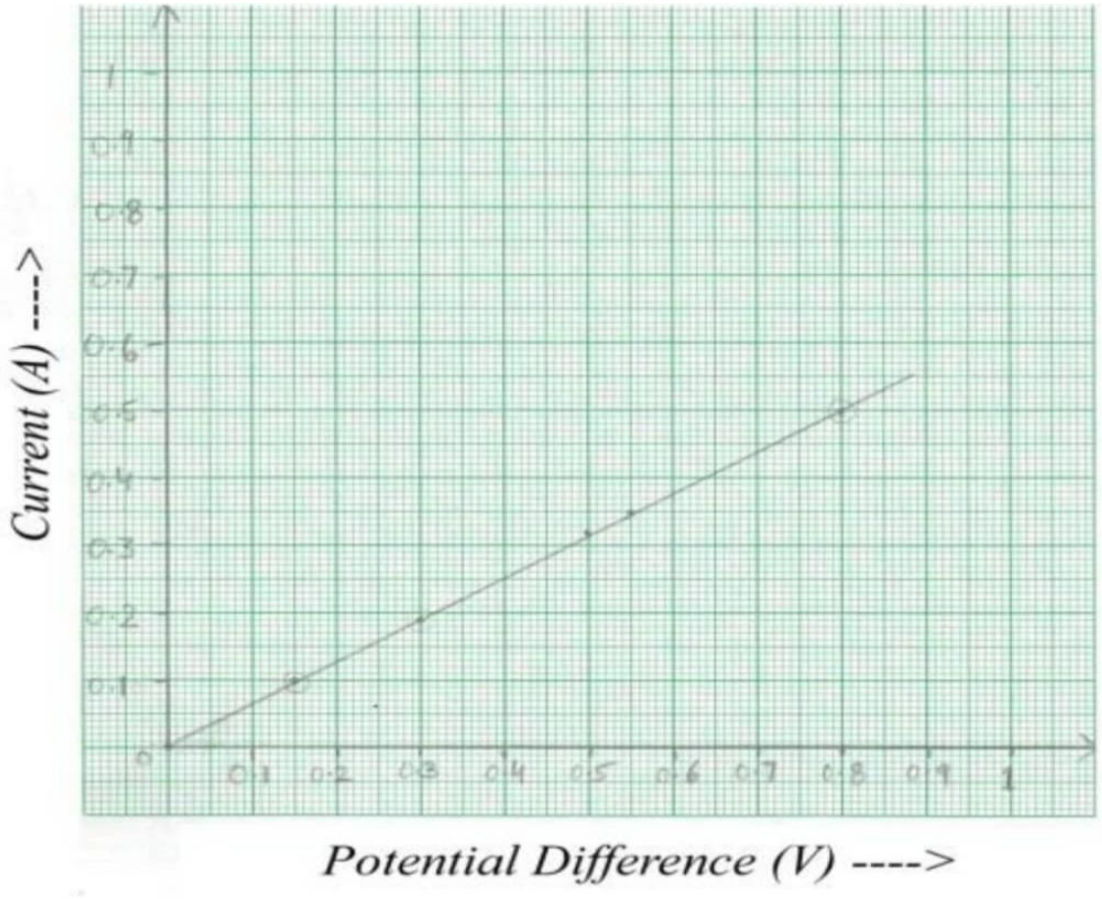


Fig. 1.1

Graph between voltage and current:



Scale: X-axis: 1 cm = 0.1 volts of potential difference

Y axis: 1 cm = 0.1 amp

The graph is a straight line .

Results:

It was found that the ratio V / I is constant, and then the voltage and current relationship was established and they are in direct proportion. In other words, Ohm's law has been proven:

The law is verified .

Find the unknown resistance per cm of the specified wire

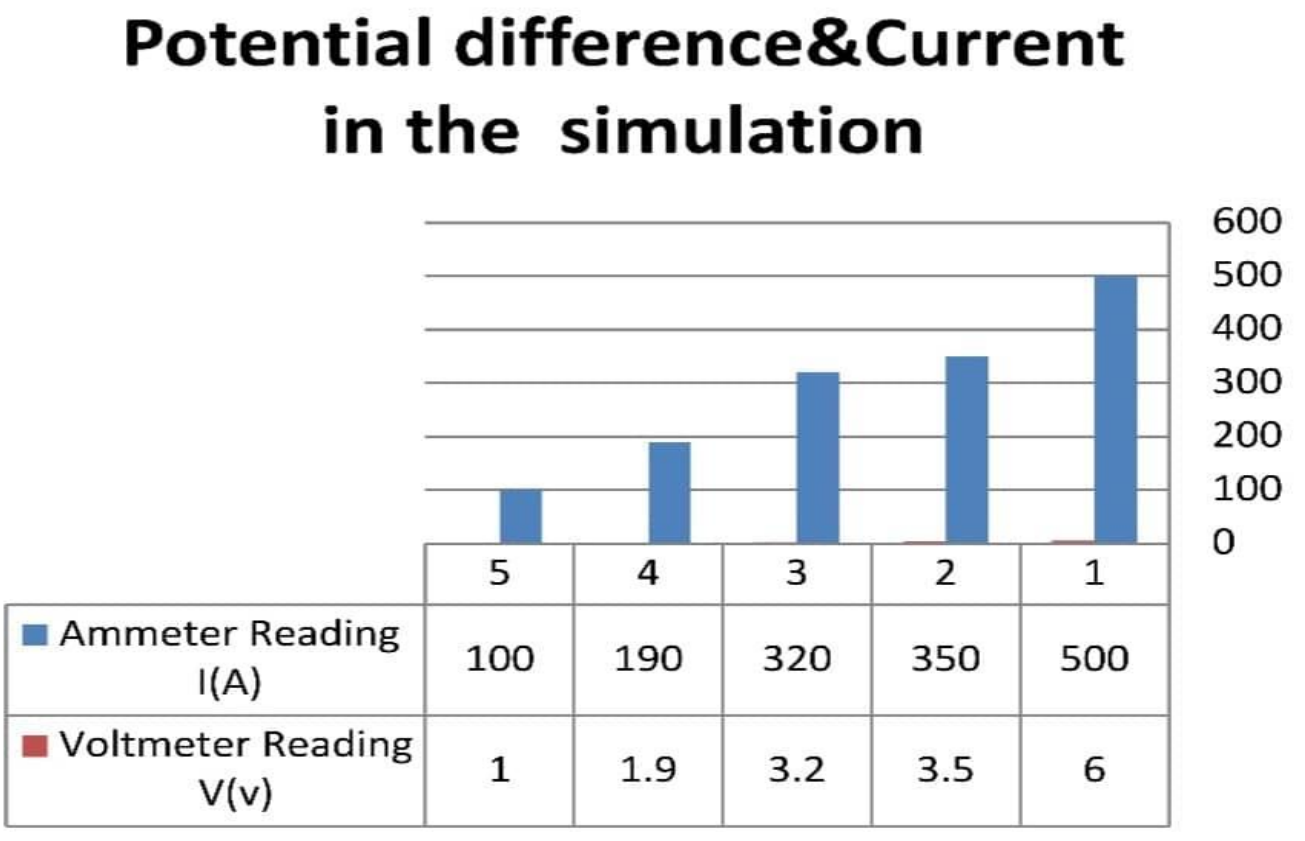
5.57 =x 10 - 2 ohms per centimeter

Possible sources of error in real-world experience:

The variable resistor may have a high resistance .

The device screws may not be properly installed .

The result of applying Ohm's law in the PhET simulation



Note that applied computing

Parameters are used corresponding to those used in the real-world experiment, and these converge with results previously observed in the remote laboratory .

Although laboratory experiments play a crucial role in engineering education, they contribute strongly to the development of skills important for professional practice. This paper addresses the researcher's understanding gap between simulations and remote laboratories. , which we are developing at the University of Tobruk, thus evaluating the researcher's perceptions taking into account simulations and remote laboratory results .

Through this experiment, quantitative data were analyzed to find out the difference and the extent of differences between the simulation software resources and the type of practical data in the laboratory .

Preliminary results indicate that a large number of results are in almost complete agreement with actual practical results .

.4 Discussion and Conclusions:

Researchers learn about the mathematical functions and equations that underlie typical physical phenomena. The content of the curriculum and its courses in the departments of Applied Physics and Electromagnetic and Electronic Engineering covers the topics of classical mechanics (kinetics, Newton's laws, energy, work, and renewable energy), electricity and circuits (Coulomb force, electric field, electric current, and electric circuits). and electronic). The overall goal of the applied science departments is to develop knowledge and understanding in these topics to mobilize and apply them to actual engineering contexts. We have worked on introducing the PhET program and used it to achieve various goals, including developing concepts and working on designing accurate practical systems .

And as we noticed in the tables that presented the results and the resources used, in addition to the time period in which the researcher had to hand over the readings as a result of this task, and showed the extent of accuracy and closeness between the far lab and the simulation lab .

We conclude that different resources (remote laboratory, simulation, and practical laboratory) allow the researcher to practice some experimental skills in a different way, but in order to make the most of them, he needs to understand the main differences in the type of measurements collected during his use. The experiment dealt with in this study deals with the researcher's perception of the difference between simulation and

remote laboratories. In order for the researcher to understand the difference between simulation and remote laboratories and the type of different results that were obtained with each of them, the research methodology adopted in this study is quantitative and qualitative [29], where each case is represented differently with the application of simulation adopted in this study .We have followed the method based on a set of questions that have been validated, and used in the approved application of the simulation (30 .)

.5 Recommendations and future studies:

The current hardship we live in is witnessing many transformations towards the use of technologies in education, and this led to the development of the educational process and achieved the goals of education more effectively and led to improving the quality of education by employing these tools in the educational process, and among those tools was the virtual laboratories, which have a roleIt greatly improves the skills of researchers due to its ability to facilitate the method of learning through simulation of the real laboratory in its functions, and aims to develop scientific thinking and provide the learner with practical experiences through virtual reality technology. Virtual laboratories are considered the main pillar in e-learning in the fieldPractical and applied, the virtual lab is considered one of the innovations of modern technology, which is an extension of the development of electronic simulation systems). (Virtual laboratories also work to provide ideal solutions to the problems that the traditional laboratory suffers from. Virtual experiments transcend the limits of time and space, and they can overcome the problem of possibilities in addition to providing the elements of safety and security.) They can also provide the opportunity for learners to simulate costly experiments. or dangerous ones, as it allows them to return them, and this is difficult to apply in real laboratories). The virtual laboratory largely simulates the traditional laboratory in its functions and events. When the researcher visits one of the virtual laboratory sites on the Internet, he can practice the laboratory activities that usually occur in the real traditional laboratory, through the use of simulated (virtual) three-dimensional devices and materials. It is as if it exists in a real laboratory. There are many studies and researches that have proven the effectiveness of using virtual laboratories in education as a study (we refer here to the effectiveness of using virtual laboratories in the collection and development of practical skills, as we have noticed in the results presented through the practical experience of measuring the resistance of a wire on a unitThe length of the wire (which concluded the effectiveness of virtual laboratories in acquiring the skills of laboratory experiments in the real laboratory .

(Which also concluded the effectiveness of the virtual laboratory in the collection of different levels of researchers. à

And we strongly recommend the need to use virtual laboratories in education, as we have the necessary competencies to operate them and the ability to use them effectively in the educational process. We also emphasize through this paper the importance of virtual laboratories and their role in developing many skills and a great impact on scientific thinking. And collection .

The use of physical, engineering and even medical virtual laboratories in the achievement and science fiction of Libyan university students, and in the applied side in particular, we believe in their ability to memorize this information and store it in the researchers' memory in a better and more effective way in practical applications .

6 References:

.1Sarı, M. (2011). The importance of laboratory courses in science and technology

Teaching in primary education and the ideas of simple tools and instruments to

Evaluate teacher candidates on science experiments. 2nd International

Conference on New Trends in Education and Their Implications. Antalya .

.2Bredderman, T. (1985). Laboratory programs for elementary school science: A meta

analysis of effects of learning. Science Education, 69(4), 577-591

.3Freedman, M.P. (1997). Relationships among laboratory instruction, attitude toward

science, and achievement in science knowledge. Journal of Research in Science

Teaching, 34(4), 343-357 .

.4Glasson, G.E. (1989). The effects of hands-on teacher demonstration laboratory

methods on science achievement in relation to reasoning ability and prior

knowledge. Journal of Research in Science Teaching, 26(2), 121-131 .

.5Shymansky, J. A. (1989). What research says about ESS, SCIS, and SAPA. Science and Children, 26(7), 33-35 .

.6Staver, J.R., & Small, L. (1990). Toward a clearer representation of the crisis in science education. Journal of Research in Science Teaching, 27(1), 79-89. 7. Stohr-Hunt, P.M .

.7(1996)An analysis of frequency of hands-on experience and science achievement . Journal of Research in Science Teaching, 33(1), 101-109 .

.8Turpin, T.J. (2000). A study of the effects of an integrated, activity-based science curriculum on student achievement, science process skills, and science attitudes . Dissertation Abstracts International, 61(11), 4329A (UMI No. AAT 9993727) .

.9Coştu, B., Ünal, S., & Ayaş A. (2007). A hands-on activity to promote conceptual change about mixtures and chemical compounds. journal Of Baltic Science Education, I (1), 35-4

. 10Bilgin, İ. (2006). The effects of hands-on activities incorporating a cooperative learning approach on eight grade students' science process skills and attitudes towards science. Journal of Baltic Science Education, 1(9), 27-37

.11Bredderman, T. (1983). Effects of activity-based elementary science on students' outcomes: A qualitative synthesis. Review of Educational Research, 53(4), 499-518 .

.12Bristow, B.R. (2000). The effects of hands-on instruction on 6th grade students' understanding of electricity and magnetism. Dissertation Abstracts International, 30 ,(01)39A (UMI No. AAT 1400301).

.13Jaus, H.H. (1977). Activity-oriented science: Is it really that good? Science and Children,14(7), 26-27 .

.14Schibeci, R.A., & Riley, J.P., Jr. (1986). Influence of students' background and perceptions on science attitude and achievement. Journal of Research in Science Teaching, 23(3), 177-187 .

.15Haury, D.L. & Rillero, P. (1994). Perspectives of hands-on science teaching. Retrieved January 2, 2003 from

http://www.ncrel.org/sdrs/areas/issues/content/cntareas/science/eric/erictoc.htm

.16C. Jara, F. Candelas, S. Puentes and F. Torres, "Hands-on experiences of undergraduate students in Automatics and Robotics",

Computer and Education, vol. 57, p. 2451-2461, 2011 .

.17M. Prensky, “Digital Natives, Digital Immigrants,” On the Horizon (MCB University Press), October 2001 .

.18J. R. Bronson, “Learning outcome achievement in non-traditional (virtual and remote) versus traditional (hands-on(

laboratories: A review of the empirical research," Computres & Education, vol. 87, pp. 218-237, 2015 .

.19J. Richardson, “Approaches to studying, conceptions of learning and learning styles in higher education,” Learning and

Individual Differences, vol. 21, p. 288-293, 2011 .

.20G. Alves, M. Marques, C. Viegas, M. C. Costa Lobo, R. Barral, R. Couto, F. Jacob, C. Ramos, G. C. D. Vilao, J. Alves, P. Guimarães and

I. Gustavsson, "Using VISIR in a large undergraduate course: Premiminary assessments results," in Global Engineering

Education Conference (EDUCON), 2011 .

.21IAOE] Winners of the GOLC Online Laboratory Award,” 11 February 2015. [Online]. Available: http://lists.onlinelists.org/pipermail/iaoe-members/2015-February/000120.html. [Accessed 2016 .[

.22I. Gustavsson, J. Zackrisson, K. Nilsson, J. Garcia-Zubia, L. Hakansson, I. Claesson and T. Lago, “A Flexible Electronics Laboratory

with Local and Remote Workbenches in a Grid," International Journal of Online Engineering (iJOE), Vols. Vol. 4, nº 2, pp. 12-16 .2008 ,

.23R. M. Salah, G. R. Alves, D. H. Abdulazeez, P. Guerreiro and I. Gustavsson, “Why VISIR? Proliferative Activites and Colaboratives

Work of VISIR Community," in EDULEARN2015 Proceedings, Barcelona, Spain, 2015 .

.24R. Koul and T. M. Dana, “Contextualized Science for Teaching Science and Technology,” T.M. Interchange, Vols. 28, Issue 2, pp .

,144-121April 1997 .

.25A. Stinner, “Contextual settings, science stories, and large context problems: Toward a more humanistic science education”,

Science Education, Vols. 79, Issue 5, pp. 555-581, 1995 .

.26N. Lima, G. Alves, C. Viegas and I. Gustavsson, “Combined Efforts to develop students experimental competences,” in

Proceedings Exp.at'15 3rd International Experimental Conference, Ponta Delgada, Azores, 2015 .

.27C. Viegas, N. Lima, G. Alves and I. Gustavsson, “Improving students experimental competences using simultaneous methods in

class and assessments," in TEEEM'14 Proceedings of the second International Conference on Technological Ecosystems for

Enhancing Multiculturality, Salamanca, Spain, 2014 .

.28N. Lima, C. Viegas, G. Alves and F. Garcia-Peñalvo, “VISIR's Usage as an Educational Resource: a Review of the Empirical

Research," in Proceedings TEEM2016 - Fourth International Conference on Technological Ecosystems for Enhancing

Multiculturality (TEEM'16), Salamanca, Spain, 2016 .

.29L. Cohen, L. Manion and K. Morrison, Research Methods in Education, 6th Edition, London and New York: Routledge, Taylor&

Francis Group, 2007 .

Lima, N., Viegas, C., Zannin, M., Marques, A., Alves, G., Felgueiras, M. C., . . . García-Peñalvo, F.J. (2017). Do students really understand

the Difference Between Simulation and Remote Labs? In J. M. Dodero, M. S. Ibarra Sáiz, & I. Ruiz Rube (Eds.), Fifth International

Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM'17) (Cádiz, Spain, October 18-20, 2017) (Article 15) .

New York, NY, USA: ACM .

.30G. Alves, A. Fidalgo, M. A. Marques, C. Viegas, M. Felgueiras, R. Costa, N. Lima, J. Garcia-Zubia, U. Hernández-Jayo, M. Castro, G .

Díaz-Orueta, A. Pester, D. Zutin and W. Kulesza, "Spreading remote labs usage: A System – A Community – A Federation," in

Proceedings of the 2nd International Conference of the Portuguese Society for Engineering Education (CISPEE2016), Vila Real,

Portugal, 2016.