

Survey Paper on Virtual Chemistry Laboratory

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Abstract- Virtual labs are powerful tools to engage students in active learning. It is suggested by researchers that practical experimentation develops a strong interest among students in learning. The aim of this research is to compare the effectiveness of Virtual Laboratory and students' attitude towards chemistry. Reports also state that students feel motivated to learn Chemistry when they make use of practical class. However, the availability of laboratories to carry out practical activities is difficult to find in different levels of education in several countries. Thus by using three-dimensional modeling, the system can show a real experimental environment. At the same time, utilizing scene interactive technology, it can implement the complex human-machine interaction in chemistry, so that the learners get the senses of realism and immersion.

Keywords- Physical Laboratory, Virtual Reality, Virtual Chemistry Laboratory.

I. INTRODUCTION

Chemistry is a unique and interesting subject. However, chemistry subject is considered to be a difficult subject among Engineering students. Some misconceptions are caused to the students regarding chemistry subject due to content of textbooks and public perceptions of chemistry. To avoid misconceptions of chemistry lessons, teachers need to focus on experiment activities at labs. Chemical experiments are an activities carried out to learn chemistry subject and help students in the development of scientific skills and promotes the application of creative thinking and student's scientific attitude. Many students report that the study of Chemistry is limited to memorize several formulas, properties and chemical equations. In addition, professors also find difficulties to relate the content studied in theory with practice. Therefore, one way to awaken this interest is to bring the theory presented in class with events that happen in daily lives. It is possible to highlight the following points: (i) The methodology in the classroom can be considered outdated; (ii) Few experimental classes; (iii) Students lack of interest, among others. In order to motivate and awaken the students in the understanding of Chemistry, some professors are not worried to change the traditional classes with more attractive methodology. However, these methods can also become inefficient and unattractive. The lack of practical classes is the main disinterest of the students in the learning process. Thus, the practical becomes essential to the students to verify why and

how chemical phenomena occur. The lack of equipment and the cost of maintenance can be considered the reasons to justify the reduction of classes in the laboratory. Some professors are not able to make the experiments, and there is no technical staff in the laboratories. Thus, without a physical hands-on laboratory, some works are trying to develop virtual tools to help in the teaching and learning of Chemistry.

II. BACKGROUND AND RELATED WORK

In order to understand the conceptual foundations of this work, this section presents the Virtual, hands-on laboratories and the Practice of Chemical Experiments. After that, some related works are presented. A Hands-on and Virtual Laboratories physical or hands-on investigations provide opportunities for students to interact directly with the material world using the tools, data collection techniques, models, and theories of science. Nowadays computer technologies are offering virtual laboratories where investigations involving simulated material and apparatus are performed. The value of physical laboratories for science learning is generally recognized but the value of virtual, simulated alternatives for hands-on physical laboratories is contested. Therefore, these kinds of laboratories are important to be investigated in educational context. A virtual laboratory brings many advantages. For example, it is possible to perform dangerous experiments without endangering yourselves or others. After developed the environment, the user is able to realize the experiment many times at no extra cost.

Advantages and Disadvantages of Classical and Virtual Chemistry Laboratory:

Classical experimental work	Virtual laboratory
+ training manual skills	+ learning about the scientific approach to work
+ learning about the scientific approach to work	+ the results are always the same
+ following instructions	+ a large range of chemicals and accessories
- preliminary preparation	+ an easy implementation of dangerous, expensive, harmful to health experiments or experiments in specific conditions
- dangerous or harmful to health chemicals	+ inexpensive
- difficult, too long or too expensive experiments	+ visualization features are included
- there are variations	- alienation from nature and from reality
	- it can be only a supplement and not a replacement of practical work

The laboratory improves student learning, because they perform and observe in real time the experiment in the environment. Also, it can be used for distance learning education. The equipment required to perform the hands-on laboratory is physically set up and the students who perform the laboratory are asked to be physically present in the laboratory. Therefore, it is difficult and costly to maintain and support laboratory equipment. The virtual and hands-on laboratories have their own characteristics. However, some researchers suggest that virtual experiments used with hands-on experiments in real world may provide the best experience. Thus, the mix of virtual and hands-on experiments is defined as blended instruction. These combinations have increased student's performance, because the previous knowledge is obtained in the virtual laboratory. Also, the students are free to carry out several tests, create scenarios and verify the behavior in the simulation environment, before the hands-on laboratory.

III. EXPERIMENTAL FINDINGS AND SURVEY

In virtual lab we can perform and uses GUIs to implement several interactive exercises, giving students practical experience of important theoretical aspects of multimedia processing. The main objective of Virtual Chemistry Lab is to make the students familiar with related theoretical topics, starting with very fundamental concepts and progressively and hierarchically building up his/her Knowledge to the level of current state-of-the-art approaches.

How is it possible to develop cost-efficient learning environment, which contains many virtual experiments with high level interactivity, a huge amount of complex 3D objects (glassware, chemical solution and equipment), and also containing real-time animated character? To do so we can use different approaches for development of full featured rich multimedia applications. The script-based approach is being used for representing high-impact multimedia content and interactivity. This approach provides extended tools to define the desired structure of content and user interaction with objects in the virtual environment, as well as it gives maximum flexibility for multimedia production.

Problems encountered in chemistry courses and solutions offered by virtual laboratories:

Reason for teachers' lack of use of the lab	Alternatives offered by virtual laboratories
Safety concerns	Experiments that involve risks in the real environment due to poisonous or unsavory gas releases can be safely performed in virtual laboratory environment /

	uncontrolled explosions (e.g., NIS) have no real-world consequences, etc
Lack of self confidence	Virtual Lab must help students and Teachers with little or no laboratory experience in selecting laboratory equipments, setting up experimental apparatus, and completing the procedure. With this exception of starting the computer or accessing the website hosting the virtual environment software, virtual environments require no prior preparation of laboratory equipments, etc.
Lack of equipment	As virtual laboratory equipments are not at risk of being broken or lost, users can use virtual laboratories easily. Experiments that cannot be conducted in a real labs due to shortage of equipments and materials can be practiced in a virtual lab without any loss.
Time shortage	Time loss has reduced in virtual laboratories as compared to time lost in real laboratories. The procedure of experiment in virtual laboratories is similar to that of real laboratories. To understand and follow the experiments is easy in virtual media. After the experiment, it is not necessary to devote time to clean the virtual laboratory. Students who become used to the virtual laboratory environment can easily perform the same experiments in the real laboratory environment.
Weaknesses of confirmation method	The interactive format of the virtual labs environment presents the problem case by arousing students interest. They are

	made to put forward and test hypothesis, and are also given the chances to make generalizations. Since all the experimental steps in the virtual laboratory are pre-planned, based on algorithms, there are no risks of the experiment producing improper results or no results at all. The students are able to perform freely within a network.
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IV. CONCLUSION

Computers and Internet have expanded the way in which information is delivered to the students. Today's technology provides a valuable opportunity to practice new learning techniques. Teachers should use Virtual labs in order to facilitate learning. Teachers must adapt current teaching methods so as to incorporate new effective media into the classroom as it has proved to be beneficial. Computers have a larger fundamental impact in most industries, thus providing a competitive advantage which is essential to many businesses. Therefore, schools and colleges in India must also use Virtual labs to improve the educational standards. The Virtual Labs will be more than a "living" textbook. The "classroom of the future" will probably contain several kinds of simulators, virtual labs in addition to textual and visual learning tools. The value of hands-on practical work as a component of science education has been debated for decades. While science educators strongly support laboratory work, there are often question marks over the purpose and goals of such activity. In recent years, austerity and the advance of technology have led to increased interest in the concept of virtual experiments that might replace traditional (and expensive) laboratory-based practical work, while still allowing students to achieve learning outcomes. Virtual lab may prevent cost-cutting errors.

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