

## A RAY OF HOPE FOR CHEMISTRY TEACHERS AMIDST OF COVID-19: VIRTUAL CHEMISTRY LABORATORIES

DR. VANITA KUMARI SAPRA<sup>1</sup>, DR. ANJU<sup>2</sup>

Goswami Ganesh Dutt Santana Dharam College, Palwal (Haryana)<sup>1,2</sup>  
vanitasapra76@gmail.com

---

### ABSTRACT

*The lab applications, which began to be used in the mid-nineteenth century, provide not only a novel point of view, but also a new depth to the courses. They were originally designed to demonstrate theoretical information, but they have since evolved into domains where students can freely find knowledge as individuals or in groups. The activities that have resulted in the recent form of labs have significantly contributed to the formation of ideal students for constructivist approaches, who explore, enquire, test, seek solutions, put on scientific shoes, and think carefully about the subject of concern.[2]*

*Laboratory activity, as an important aspect of learning chemistry, offers students with a learning experience based on their interactions with real-world materials.*

*Laboratory applications are well known to have a consequential role in chemistry teaching. Virtual labs and simulations are a great way to get students involved in active learning.[1] So, in the present scenario of COVID-19 Pandemic, Virtual Chemistry Laboratories are boon for students. In this paper, the aim, advantages and disadvantages of virtual labs were reviewed.*

**Keywords:** Virtual, Learning, Chemistry, COVID-19

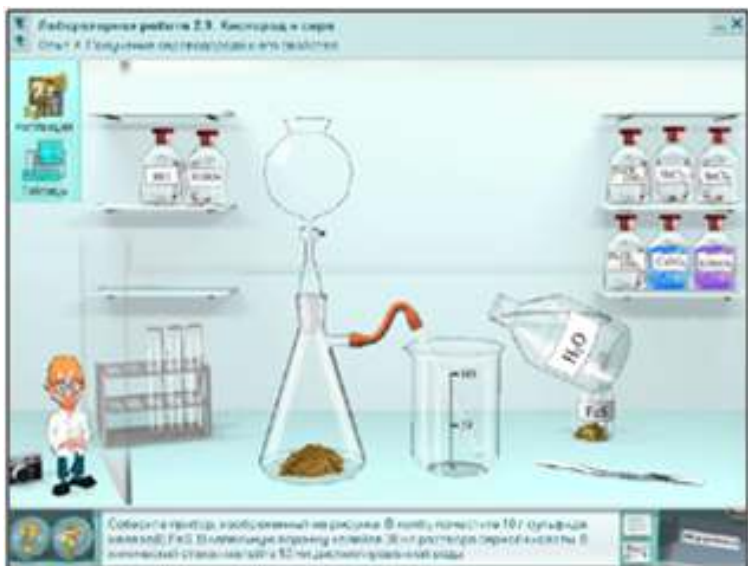
### Introduction

Investigation and experimentation, which primarily take place in laboratory settings, are the fundamental sources of scientific information, skills, processes, and experiences. Information and communication technologies (ICTs) have been infiltrating practically every aspect of human endeavour, including education, for more than two decades. Many abstract concepts in science education that could only be taught theoretically with certain basic assumptions and misconceptions in students' minds are now taught practically with the use of technology.[5] Chemistry has been one of the science subject that has benefited from the emergence of abstract ideas such as the atom, molecule, molecular structure, and bonding. According to Tatli and Ayas [6], chemistry is one of the science subjects that contain a lot of abstract concepts which eventually cause serious misconception among students and the problems of conceptualization to the teachers. Learning with virtual reality, on the other hand, provides a new set of opportunities and experiences for obtaining and creating knowledge. It makes dangerous experiment performance much easier. Virtual reality is a technology-based simulated environment that allows for virtual real-time interaction.[7]

Virtual labs are simulated learning environments that allow students to complete laboratory experiments online and explore concepts and theories without stepping into a physical science lab. A virtual laboratory is defined as any computer-based or technology-supported setting in which the learner interacts with experimental equipment with the goal of observing and testing a hypothesis for confirmation or generating new information. The control of an apparatus, as well as other experimental processes and processes, are virtually in the hands of the learner in this type of environment. A virtual laboratory is a technology-based educational tool that can give effective learning with nearly all of the elements of a real laboratory for experimentation. The use of a virtual laboratory in chemistry practical can help students improve their practical abilities in analytical chemistry. [4]

Practical chemistry, on the other hand, is an activity in which students work independently or in groups in a laboratory or any other location designated for conducting experiments and making observations or manipulations of real objects and phenomena. Chemistry practical's are required since the topic tries to comprehend the chemical composition, nature, properties, and transformations of matter. All five senses are used in the observation and manipulation of processes when conducting practical's. Students' attitudes and achievement in chemistry and other science topics are found to be favourably influenced by these practical knowledge and abilities.

Therefore, Virtual labs are essential part of chemistry teaching in this tough time of COVID-19 where all teaching is done virtually and virtual labs becomes an efficient tool for chemistry teachers to make concepts clear to their students.



## VIRTUAL CHEMISTRY LABORATORY

### Benefits of Chemistry Virtual Laboratory

The virtual chemistry laboratory's features make it effective and useful for practising practical chemistry. Among the advantages are the following:

**1. Flexible access:**

The ability to learn at the student's leisure and when he or she learns best is perhaps the most frequently touted benefit of any online learning. The same is true of virtual laboratories if the experiments are on the student's own time. In other circumstances, a virtual lab can be used during regular class time, which reduces the benefit but still gives the teacher more freedom because resources are not limited by time.

**2. Instant feedback:**

While engaged in critical thinking mode, students can redo experiments on the spot. All of the findings are kept track of, which helps teachers and students communicate more effectively. Experiments no longer have a "one chance" option, and students can instantly assess what went wrong and try again.

**3. Top-notch equipment:**

When it comes to experimentation, students who use virtual laboratories have access to cutting-edge equipment. Companies that create and manage virtual labs must compete with one another in order to remain ahead of technological advancements, which improves the quality of alternatives available to students. Students don't have to settle for outmoded, but expensive, equipment because a school can't afford to upgrade it on a regular basis with a virtual lab.

**4. Lower costs:**

Virtual labs have a price connected with them, but the capital and maintenance costs are significantly reduced. Instead of one school bearing the entire expense of resources, the expense is shared among the virtual lab's clients. This enables the school to provide a better learning environment for children at a lower cost.

**5. Change in System of Configuration:**

In a real laboratory, many parameters with many machines cannot be tempered or changed to the required unit and fraction because the manufacturer did not provide space for it, whereas in virtual laboratories, similar machines and parameters could be changed to suit the unit and functions needed for the experiment.

**6. Multiple Access:**

Many students can access the same experiment in the virtual chemistry laboratory from a different location at the same time. It gives room for students to re-experiment any experiment they carried out at anytime and anywhere. A student is only required to log in using his username and password and access the environment.

**7. Students' Interest and Engagement:**

Due to technology's infiltration into every nook and crevice of human endeavour, today's students are enthralled and like working with it. Instead of playing pointless games and chatting on their phones, students might utilise their phones to play interactive games in the virtual chemistry lab, which would keep students interested, motivated, and engaged.

According to Paula [8], the virtual chemistry laboratory is a technology-based laboratory with quite interesting and amazing features, facilities and interactive games that make students feel highly motivated and engaged in learning, showing the willingness and temptation to discuss the experience they gained through the use of virtual laboratory in conducting experiments.

**Advantages to Students**

1. Protect pupils from the dangers they may encounter while performing hazardous laboratory activities. It avoids the need to deal with hazardous substances, such as those that are toxic or radioactive, as well as other risks such as electrical connections. As a result, it's a good strategy to avoid laboratory mishaps.
2. Help students study and prepare laboratory experiments at any time and place.
3. According to his or her aptitude to assimilate knowledge, the student can repeat the experiment multiple times. In a practical laboratory, this is typically impossible to do due to a scarcity of material and equipment in relation to the number of pupils.
4. The student is given the opportunity to control the inputs of the experiment, change the different transactions, and observe the changes in the results without the existence of a supervisor and without being exposed to any risks.
5. The ability to record all the results electronically, which helps in analysing them using the latest software programs and sharing the results and analysis with others.
6. Provide a comprehensive overview for the learner about the hazardous experiments which are not safe in the real world, thus providing him/her with a greater absorption of the course.
7. Virtual labs allow students to perform the practical experiments related to the theoretical courses, which helps them absorb the courses.
8. The virtual lab provides enjoyment during experiments.
9. Virtual labs allow students to stay in touch with the Internet, which helps them search and gather information during the experiment.
10. Virtual Labs enable students to record results electronically and share them with others to exchange experiences.
11. Virtual labs enable students to perform many experiments that are difficult to perform in real laboratories because of the risks.

**Advantages to Teachers**

1. Assist the teacher in covering all components of the course curriculum with practical applications and assisting the student in understanding all points of the course curriculum, which is challenging to provide with limited equipment and funding.
2. Help teachers study and prepare laboratory experiments at any time and place.
3. Help the teacher to evaluate students electronically and easily to guide them and follow their progress in conducting experiments.
4. Save time and effort for researchers by eliminating the need to move between different laboratories.
5. Save time and effort for researchers by eliminating the need to move between different laboratories.
6. Virtual Labs help users keep up with the technological development of the digital age.
7. Virtual labs enable teachers to use the latest technologies

**Impediments to use virtual labs[9]**

1. They require computer devices with high specifications in order to simulate the exact phenomena with full details and create a three-dimensional virtual lab.

## Proceedings of DHE approved One Day National Seminar on Role of Digitization during COVID-19

2. They require professional programmers with strong skills in different programming languages. They also require a team of experts in the scientific material, teachers, and experts in psychology.
3. One of the negative effects of Virtual Labs is that it reduces the direct interaction between students and each other, and between students and teachers, given that the communication between them is electronically most of the time.

### Conclusion

Creating an active and engaging learning environment is an essential part of successful learning strategy. Thus, despite of few setbacks, Virtual Chemistry Laboratories can be used as an alternative to real laboratories in the present situation to provide students a real time experience of Chemistry Learning.

### References

1. [https://www.researchgate.net/publication/4104908\\_Virtual\\_chemistry\\_laboratory\\_for\\_school\\_education](https://www.researchgate.net/publication/4104908_Virtual_chemistry_laboratory_for_school_education)
2. [https://www.researchgate.net/publication/232415435\\_Virtual\\_laboratory\\_applications\\_in\\_chemistry\\_education](https://www.researchgate.net/publication/232415435_Virtual_laboratory_applications_in_chemistry_education)
3. [https://www.ds.unipi.gr/et&s/journals/16\\_1/14.pdf](https://www.ds.unipi.gr/et&s/journals/16_1/14.pdf)
4. <https://www.ijeat.org/wp-content/uploads/papers/v8i5C/E10790585C19.pdf>
5. Mancas D. The role of virtual laboratories in education. Evaluation. 2003;12:135–40.
6. Tatli Z, Ayas A. Virtual laboratory applications in chemistry education. Procedia - Soc Behav Sci. 2010;9:938–42.
7. Yusoff MF, Aida J, Bakar A, Mat RC. Possible Youth Acceptance and Contributing Factors of Virtual Reality Application for Islamic Content Learning. Int J Recent Technol Eng. 2019;7(6):136–45.
8. Paula H. 5 minutes to read Comments: 4 EDUCATIONAL TECHNOLOGY The Pros And Cons Of Using Virtual Reality In The Classroom [Internet]. 2016. Available from: <https://elearningindustry.com/pros-cons-using-virtualreality-in-the-classroom>
9. <https://blog.praxilabs.com/2018/03/01/important-advantages-impediments-use-virtual-lab/#:~:text=1%2D%20Virtual%20labs%20enable%20students,from%20one%20place%20to%20another.>