

Report on  
**Online Workshop on Virtual Labs**  
April 5-6, 2021

Organized by

**HELP University, Malaysia**

In collaboration with

**Commonwealth Educational Media Centre for  
Asia, New Delhi**

Report Submitted  
by

**Mr. Saneesh P F**

Project Manager

Virtual Labs

Amrita Vishwa  
Vidyapeetham

## Introduction

Virtual Labs is an initiative of the Ministry of Education, Government of India under the National Mission on Education through Information and Communications Technology (NME-ICT). This initiative provides an opportunity for all students to use virtual labs free of cost. The aim to provide high quality remote laboratory access in Science and Engineering disciplines for students and teachers and is applicable to undergraduate (B.Sc., B.Tech, B.E.) and post-graduate (M.Sc., M.Tech, M.E.) students including Physical Sciences, Biological Sciences, Chemical Sciences, Computer Science and Electronics and Mechanical Engineering. Virtual Labs are being developed by a consortium of 12 institutes which include Amrita Vishwa Vidyapeetham, IIT Delhi, IIT Bombay, IIT Kanpur, IIT Kharagpur, IIT Madras, IIT Roorkee, IIT Guwahati, IIIT Hyderabad, Dayalbagh Educational Institute, NIT Surathkal and College of Engineering, Pune.

Main website: <https://www.vlab.co.in/>

University website: <http://vlab.amrita.edu/>

Virtual Labs are new immersive e-learning environments that provide a media-rich, interactive user interface that teachers can use to supplement their curriculum. These labs are located on an open webpage that can be accessed by anyone through a web browser, on any Internet-connected computer in the world. A variety of laboratory experiments can be conducted virtually using animation, simulation, or remotely triggered hardware. Laboratory experiments are modeled very close to real-life experiments and when used as a learning tool by students it allows them to learn the material more efficiently and can make doing the practical experiments easier.

Amrita Online labs (OLabs) is an educational initiative pioneered by Amrita CREATE (Center for Research in Advanced Technologies for Education) at Amrita Vishwa Vidyapeetham in partnership with CDAC, Mumbai, under a research grant from the Ministry of Electronics and Information Technology, Government of India. This initiative provides an opportunity for all students from classes 9 to 12 to understand and perform online laboratory experimentation free of cost. The aim is to provide high quality laboratory access in Science, Mathematics and English disciplines for students and teachers. The lab hosts virtual experiments in Physics, Chemistry, and Biology developed by Amrita CREATE for students from classes 9 to 12 with content aligned to NCERT/CBSE and State Board Syllabus. The Mathematics and English labs are developed by CDAC Mumbai.

Main website: <http://www.olabs.edu.in/>

The development of OLabs includes the study and use of mathematical techniques to demonstrate various complex functions in diverse areas of science. This makes use of complex user-interactive simulations and detailed animations. OLabs combine technology resources, automation, along with tried-and-true training concepts. These are richly featured platforms meant to provide a compelling and personalized experience for learners, one that goes beyond just looking at content or interacting with simulations. They enable hands-on training whenever and wherever needed.

Laboratory experiments are an integral component of science and engineering education. However, access to lab equipment is often limited due to geographical distances and resource constraints. Virtual or online labs provide an alternative to physical hands-on labs where such labs are not present or augment existing access to experiments. Further, virtual labs, as innovative interactive multimedia platforms for online and blended learning, can enhance the teaching and learning experience and outcomes. There is, therefore, an urgent need for effective deployment, use, and integration of virtual labs into curricula. Recognizing this need, the Commonwealth Educational Media Centre for Asia

(CEMCA), in partnership with the HELP University, Malaysia, facilitated a capacity building programme in the use of virtual labs for faculty members of HELP University.

## **Aim**

This programme aimed to create awareness about virtual labs for internet-based experimentation and to enable faculty members to use virtual labs and to integrate them effectively in teaching practice.

## **Objectives**

Participants would be able to:

- Demonstrate awareness about virtual labs
- Use virtual labs for performing experiments
- Integrate virtual labs into teaching and learning practice

## **Invitation**

CEMCA, New Delhi invited Amrita Virtual labs to conduct a two-day online workshop on 5<sup>th</sup> and 6<sup>th</sup> April 2021 for faculty members of HELP University, Malaysia.

## **Participants**

Forty-three faculty members from HELP University attended the programme. Participants from multiple departments including Matriculation Centre, A-levels, Graduate School, Centre for Learning and Teaching, and from diverse disciplines including Sciences, Education, Psychology, and ICT actively participated in the programme. The list of participants is placed in Appendix 1.

**Dates:** The workshop was for two days – April 5<sup>th</sup> and 6<sup>th</sup> 2021 from 11:30AM to 1:30PM (IST)

**Venue:** The workshop was conducted online through the virtual platform MS Teams.

## **Methodology**

The capacity building workshop was conducted online through Microsoft Teams platform. The methodology used was live demonstration of Virtual Lab experiments from university website [vlab.amrita.edu](http://vlab.amrita.edu) and [olabs.edu.in](http://olabs.edu.in) followed by hands-on practice by participants using the assignment questions provided by the resource person. HELP university LMS platform was utilized for sharing the learning materials and conducting online quizzes.

**OLTA: Online Workshop on Virtual Labs (April 2021)** Follow up

- Events occurred in the past
- Teams meeting
- NADZIRAH BINTI MIOR NASIR <nadzirah.mn@help.edu.my> invited you

Messages **Meeting Details**

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**Microsoft Teams meeting**

**Join on your computer or mobile app**  
[Click here to join the meeting](#)

[Learn More](#) | [Meeting options](#)

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**Organizer**

- N** NADZIRAH BINTI MIOR N...

**Attendees**

- HT** HELP HR TRAINING Required
- TD** TANG U-LIANG, DR Required
- F** FONG, PUI KWAN, DR Required
- AP** A PADMASSINI Required
- O** OOI, KOK KEE, DR Required
- J** JENNIFER TAN, POH SIM, ... Required
- HL** HENRY LIM Required

*Microsoft Teams Meeting link sent to the participants and expert*

## HELP University Learning Management System

As part of the online workshop, organizers provided access to the HELP university LMS platform for providing virtual lab guidelines, online quizzes, mini-assignments, and practice exercises. Organizers created a course in the LMS called *Online Workshop on Virtual Labs* and all the participants were enrolled into this course for accessing learning materials and conducting quizzes.

HELP University Homepage Learning Resource Centre

Mr. Saneesh P F Message

Customise this page

Recently accessed courses

- Online Learning, Teaching & Assessment (OLTA)  
Online Workshop on Virtual Labs (Apr 2021)

Course overview

▼ All (except removed from view) ▼

Course name ▼ Card ▼

HELP University LMS dashboard



Course outline in the LMS

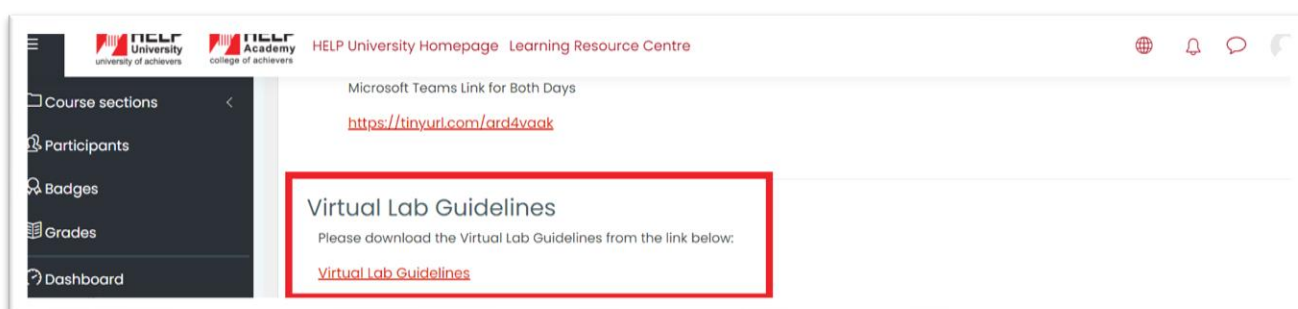
## Workshop Schedule

Day 1: 5 April 2021		
Time	Activity	Session details
11:30AM – 11:50AM (IST) 2:00PM-2:20PM (MYT)	Address by Professor Madhu Parhar, Director CEMCA  Address by Professor Andy Liew Teik Kooi Pro Vice-Chancellor HELP University  Address by Professor Datuk Paul Chan, Hon'ble Vice-Chancellor HELP University	Inaugural session
11:50AM – 12:20PM (IST) 2:20PM – 2:50PM(MYT)	Technical sessions by Mr. Saneesh P F, Project Manager, VALUE Virtual Labs Amrita Vishwa Vidyapeetham, India  Introduction to Virtual Labs (Presentation and video)	Participants gain an overall understanding of virtual labs; the concept and overview; virtual lab related activities
12:20PM – 01:20PM (IST) 2:50PM – 3:50PM(MYT)	Demonstration of virtual lab experiments from Physics, Chemistry, Biology, and Computer Science.  Hands-on activity	Participants learn how to perform experiments through virtual labs
01:20PM – 01:30PM (IST) 3:30PM – 4:00PM(MYT)	Q&A session  Practice assignments	Queries shared and answered  Practice assignments explained

Day 2: 6 April 2021		
Time	Activity	Session Details
11:30AM– 11:40AM(IST) 2:00PM – 2:10PM(MYT)	Opening session	Recapitulation of overview of virtual labs
11:40AM - 11:50AM(IST) 2:10PM – 2:20PM(MYT)	Impact of virtual labs	Significant research findings on virtual labs presented
11:50AM – 12:45PM(IST) 2:20PM – 3:15PM(MYT)	Virtual Lab experiment demonstration and hands-on activity	Participants learn how to perform experiments through virtual labs
12:45PM – 01:15PM(IST) 3:15PM – 3:45PM (MYT)	Demonstration of multiple online laboratories and simulations	
01:15PM – 01:25PM (IST) 3:45PM – 3:55PM(MYT)	Q&A Session	Queries and observations shared
01:25PM – 01:30PM(IST) 3:55PM – 4:00PM(MYT)	Closing session  Closing remarks by Mr. Kok Cheang Loh, Director of the Centre for Learning & Teaching at HELP University	

## Materials for the workshop

Learning materials were uploaded to the LMS platform prior to the workshop. These included a User guide which provides an overview of virtual lab platform and how to use virtual labs.

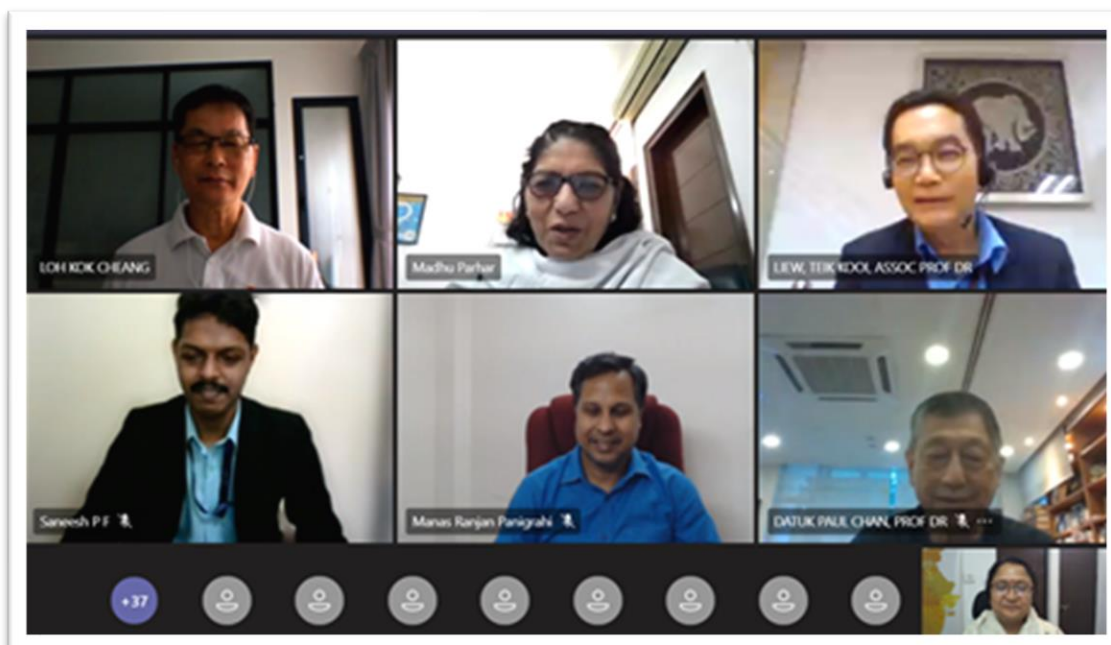


*Virtual lab guidelines uploaded to the LMS platform*

## Day 1 - Inauguration: April 5<sup>th</sup> 2021

The inauguration was graced by the presence of Prof. Datuk Paul Chan, Hon'ble Vice-Chancellor, HELP University; Prof. Madhu Parhar, Director, CEMCA, Dr. Andy Liew Teik Kooi, Associate Professor, Pro Vice-chancellor, HELP University; Mr. Kok Cheang Loh, Director of the Centre for Learning & Teaching at HELP University; Dr. Manas Ranjan Panigrahi, Senior Programme Officer, CEMCA and Dr. Shiffon Chatterjee, Senior Programme Officer, CEMCA. Mr. Loh from HELP University welcomed all the dignitaries and delivered a brief overview of the event and mentioned the potential of the virtual labs in teaching and learning. Dr. Shiffon Chatterjee delivered the welcome address. Dr. Andy Liew addressed the audience and mentioned that virtual labs is very helpful for digital transformation of institution, covering various aspects from culture to teaching-learning activity to designing enterprise. He expressed his gratitude to CEMCA and looked forward to a continuing collaboration with CEMCA which would serve as a platform for sharing innovative knowledge and expertise. Prof. Madhu Parhar spoke of the importance of learning about virtual labs and how to incorporate virtual labs in the teaching-learning process, particularly to support learning through experiments when access to physical labs is limited. She highlighted that virtual labs created under the Government of India initiative are under OER; any student and teacher could access these virtual labs free of cost.

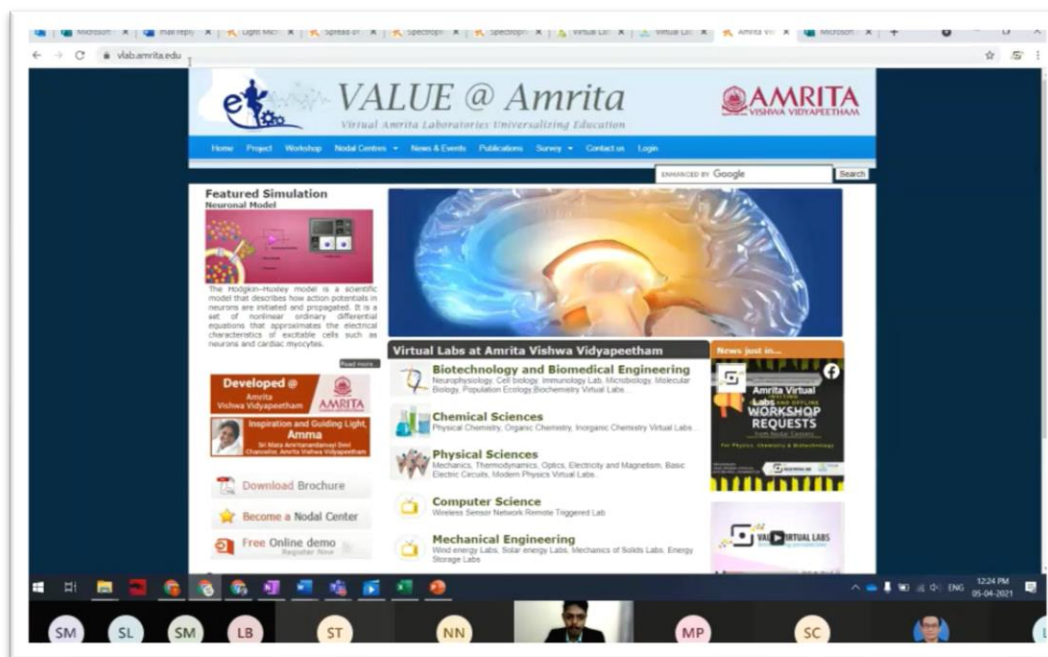
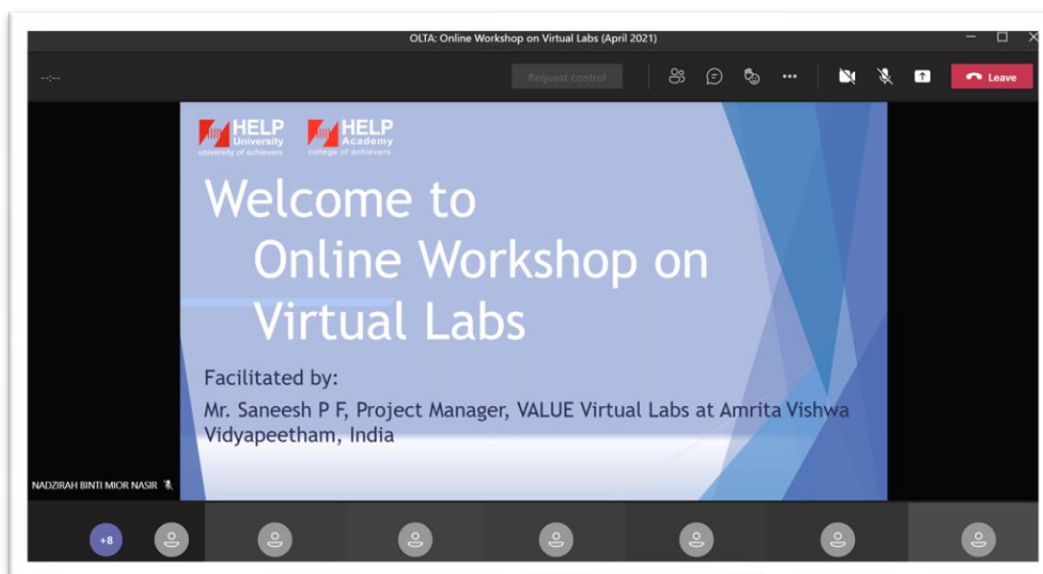
Prof. Datuk Paul Chan expressed his appreciation of this initiative by CEMCA. During the inaugural address, Prof. Paul Chan emphasised the importance of virtual laboratories in society, particularly how such learning environments can help differently abled people and contribute towards their economic and social well-being.



Mr. Saneesh P F served as a resource person of the workshop. He demonstrated various experiments in Physics, Chemistry, Biology, Math, and English. He delivered a talk on how to transform teaching using virtual labs and shared research findings regarding how virtual labs are effective for students and faculty members.

## Session details from 11:30AM to 1:30PM (IST)

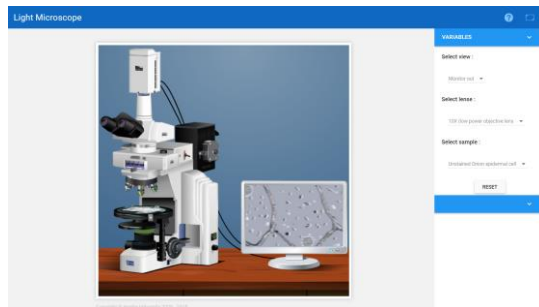
*Introduction to the online laboratory:* Mr. Saneesh presented the overview of the virtual lab project and he demonstrated experiments from vlab.amrita.edu and vlab.co.in. In between the sessions, he asked several questions to the audience through polls. The audience submitted their answers through polls so that the presenter could have a good interaction with the audience.



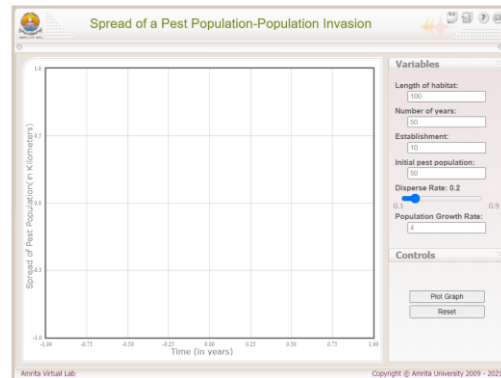
*Mr. Saneesh P F demonstrating virtual lab experiments*



## Virtual Lab Experiment Demonstration



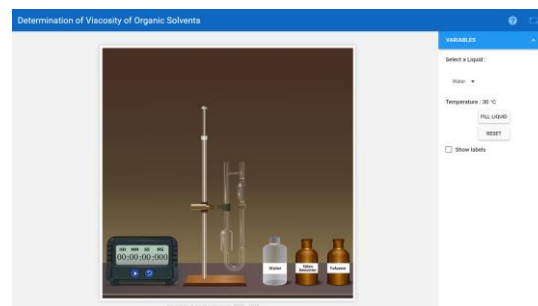
*Light Microscope - Biotechnology*



*Population Invasion - Biotechnology*



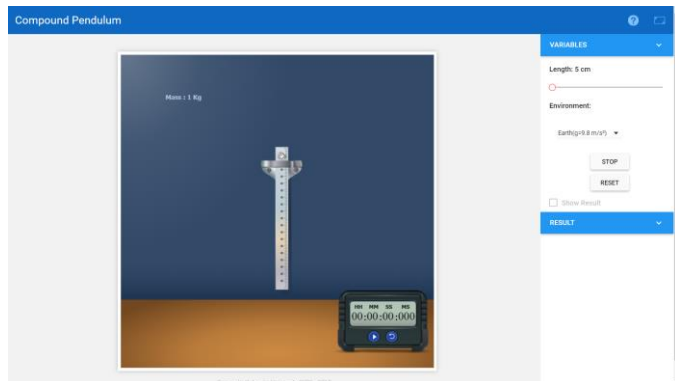
*Spectrophotometry - Chemistry*



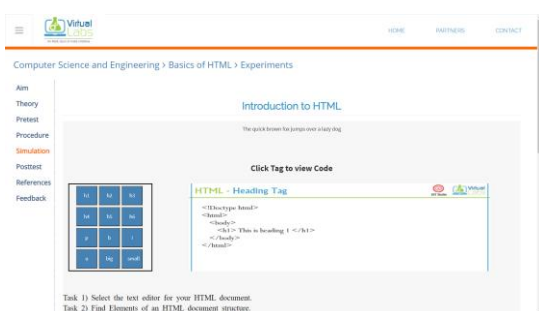
*Determination of Viscosity of Organic Solvents - Chemistry*



*Magnetic Field Along The Axis of A Circular Coil Carrying Current - Physics*

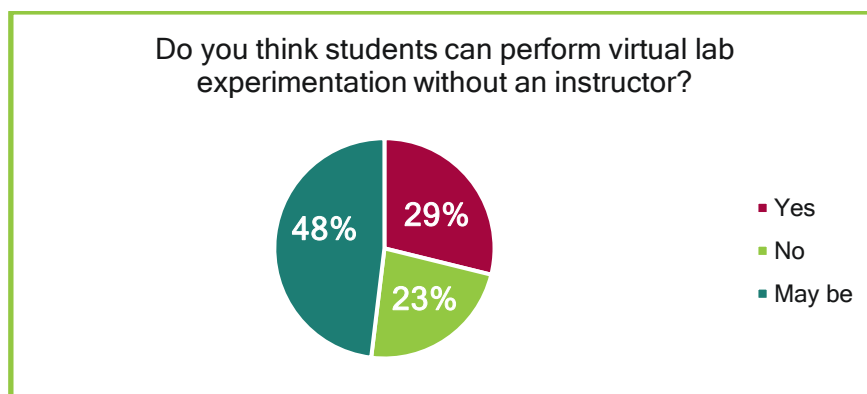
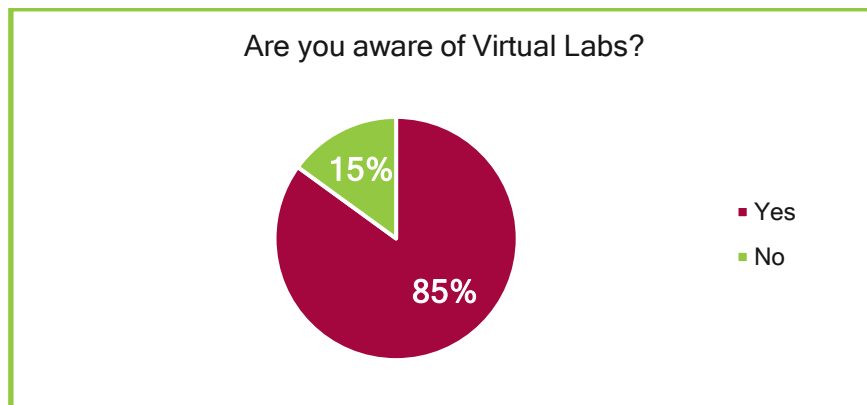


*Compound Pendulum- Symmetric- Physics*



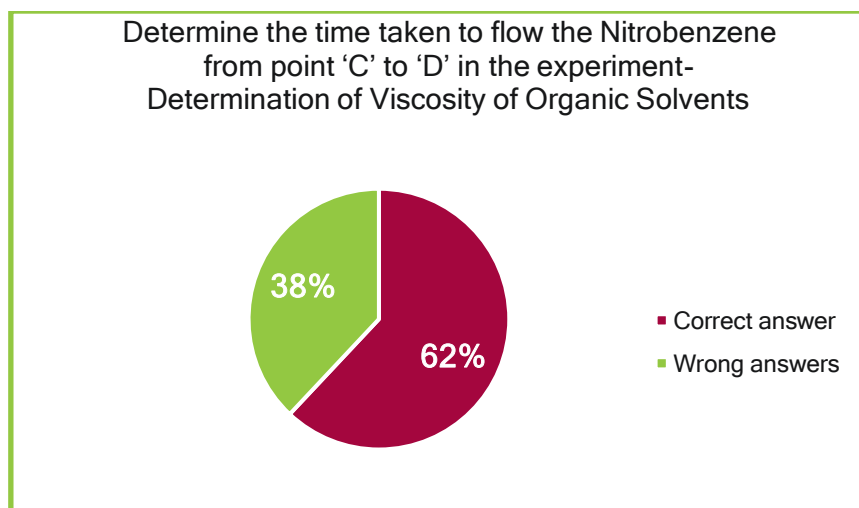
*Introduction to HTML - Computerscience*

## Poll question responses



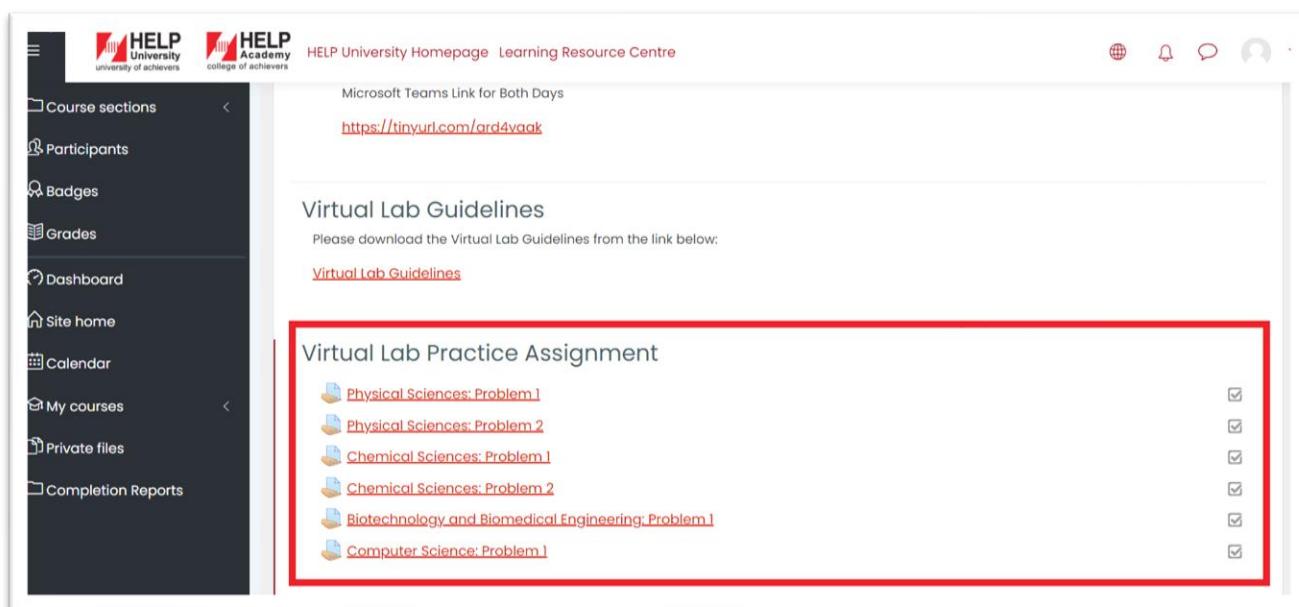
### Exercise 1

During the workshop, participants were requested to perform experiments based on the questions provided in the polls. All the faculty members participated in the exercise to answer the poll question.



## Virtual lab practice assignment questions

For practicing virtual lab experimentation, a set of assignments were uploaded to the LMS portal. All the participants were able to access the assignment after the day-1 workshop.



Virtual Lab assignment uploaded in the LMS portal

## Assignments questions for Day 1

### Physical Sciences

**Problem 1:** A brick is thrown upward from the top of a building at an angle of  $25^\circ$  to the horizontal and with an initial speed of 15 m/s. If the brick is in flight for 3 s, how tall is the building?

Link: <https://vlab.amrita.edu/index.php?sub=1&brch=74&sim=191&cnt=1>

**Problem 2:** For a circular coil of 30 turns and diameter 10cm, find the magnetic field at the centre of the coil, if 1A current flows through it. Also obtain the fields at different points on the axial line and verify the Gaussian distribution of magnetic field.

Link: <https://vlab.amrita.edu/index.php?sub=1&brch=192&sim=972&cnt=1>

### Chemical Sciences

**Problem 1:** Find out the unknown concentration of the sample – Rose Bengal.

Link: <http://vlab.amrita.edu/index.php?sub=2&brch=190&sim=338&cnt=1>

**Problem 2:** Determine the absolute viscosity of organic liquids.

Link: <http://vlab.amrita.edu/index.php?sub=2&brch=190&sim=339&cnt=1>

### Biotechnology and biomedical engineering

**Problem 1:** Spread of a Pest Population - Population Invasion

Link: <https://vlab.amrita.edu/index.php?sub=3&brch=65&sim=180&cnt=1>

**Problem 2:** Light Microscope

Link: <https://vlab.amrita.edu/index.php?sub=3&brch=187&sim=323&cnt=1>

## Computer science

**Problem 1:** How many number of swaps needed to sort the numbers 27, 61, 82, 64, 27, 62 in non-decreasing order, using Bubble Sort?

Link: <https://ds1-iiith.vlabs.ac.in/exp/bubble-sort/exp.html#Basic%20Concept>

**Problem 2:** Which tag is used for largest heading?

Link: <https://html-iitd.vlabs.ac.in/basics-of-html/exp/introduction-to-html/simulation.html>

## Closing remarks

During the closing session, Prof. Madhu Parhar mentioned the need for faculty members to explore the experiments themselves which would help to make an impact on the teaching-learning process. Mr. Loh thanked the resource person and CEMCA for Day1 of the workshop.



*Prof. Madhu and Mr. Loh addressing during the closing session.*

## Day 2 –April 6<sup>th</sup> 2021

Mr. Loh welcomed all the dignitaries and the resource person. He mentioned that faculty members from HELP University had started exploring the simulations and animation and found them to be very useful. Prof. Madhu welcomed all the faculty members to the second day of the workshop and provided an overview of the second day of the workshop to the participants.

Mr. Saneesh delivered a talk on the impact of virtual labs using several research articles. He explained learning activities that teachers can implement in the classroom to transform the teaching process using virtual laboratories. After that, he demonstrated school-level virtual lab experiments from various disciplines- Mathematics, Biology, Physics, Chemistry, and English. During the session, the resource person provided several tasks to the participants so that hands-on experience of virtual laboratories could be acquired. All the participants actively engaged with the hands-on session and interacted with the resource person.



*Prof. Madhu and Mr. Loh welcome the participants during the opening session of the second day of the workshop*



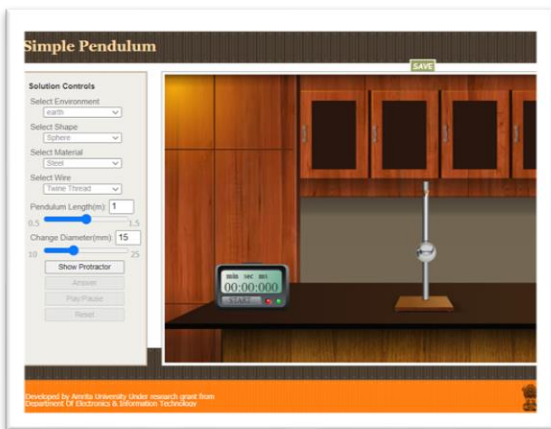
*Mr. Saneesh delivering talk on impact of virtual labs.*

## **Significant impact of virtual labs- Research studies**

The Amrita Virtual Lab team has conducted various research studies to identify the impact of virtual labs among students and institutions. Mr. Saneesh shared some of the research findings with the participants. He presented the following research articles:

- Kolil, V. K., Muthupalani, S., & Achuthan, K. (2020). Virtual experimental platforms in chemistry laboratory education and its impact on experimental self-efficacy. *International Journal of Educational Technology in Higher Education*, 17(1), 1-22.
- Achuthan, K., Kolil, V. K., & Diwakar, S. (2018). Using virtual laboratories in chemistry classrooms as interactive tools towards modifying alternate conceptions in molecular symmetry. *Education and Information Technologies*, 23(6), 2499-2515.
- Achuthan, Krishnashree, Sayoojyam Brahmanandan, and Lakshmi S. Bose. "Cognitive Load Management in Multimedia Enhanced Interactive Virtual Laboratories." *Advances in Intelligent Informatics*. Springer, Cham, 2015. 143-155.

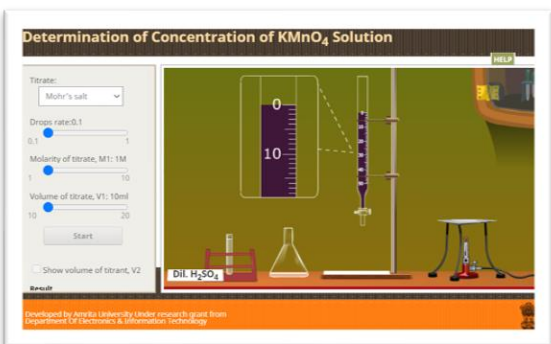
School level virtual lab experiment demonstration



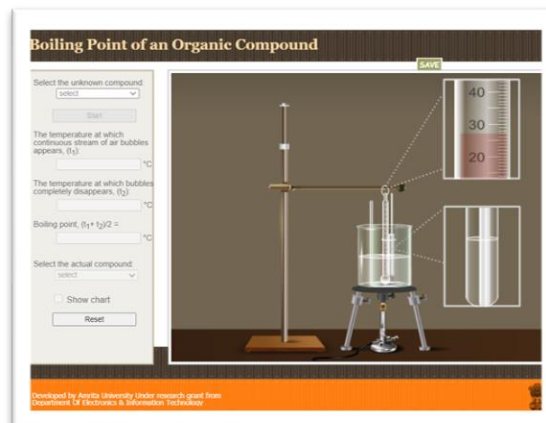
Physics: Simple pendulum



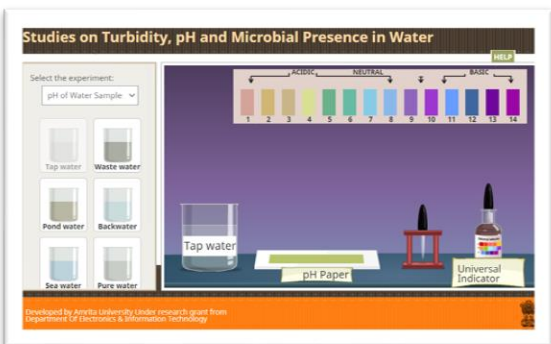
Physics: Ohm's law and resistance



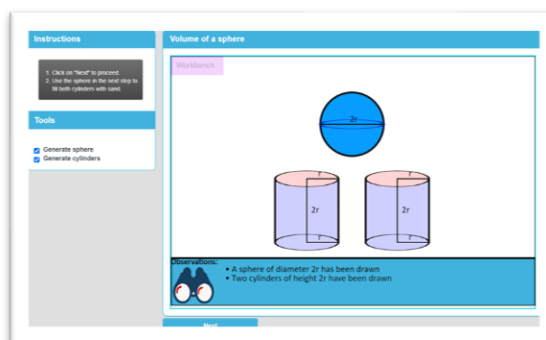
Chemistry: Determination of concentration of  $KMnO_4$  solution



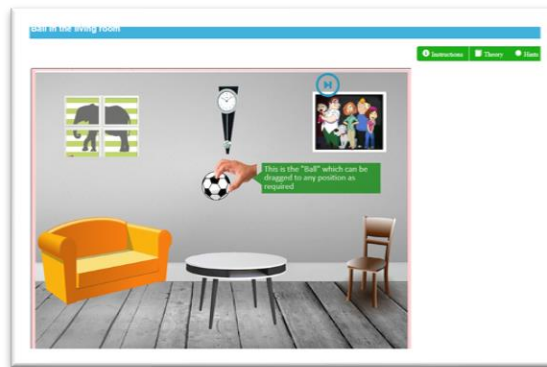
Chemistry: Boiling point of Organic solvent



Biology: Studies on Turbidity, pH and Microbial Presence in Water

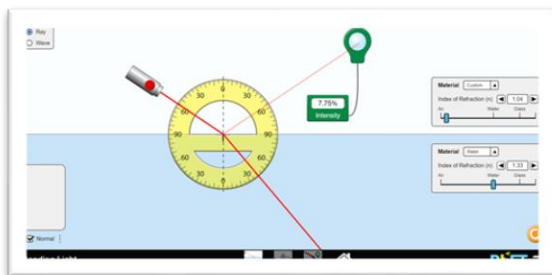


Mathematics: Volume of a sphere

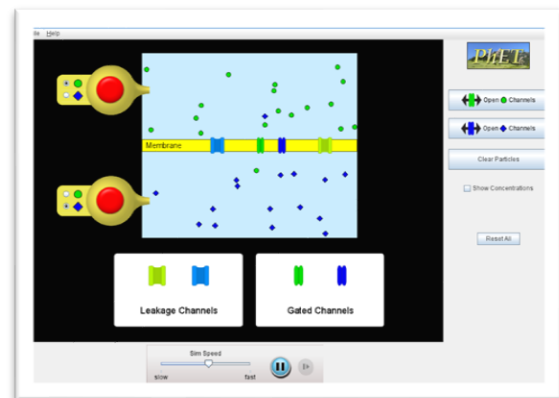


English: Learning Prepositions of Location

## Merlot Virtual Labs



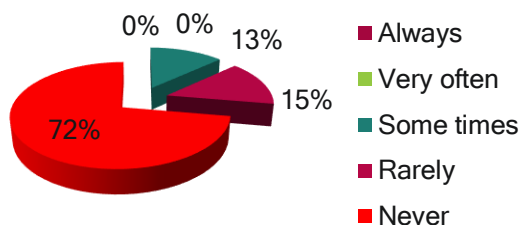
Physics: Bending of light



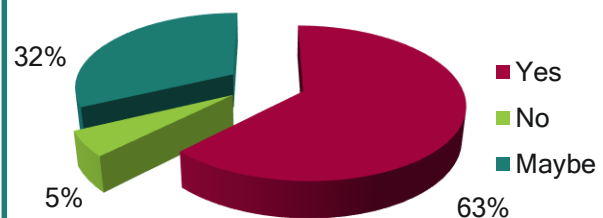
Biology: Membrane Channels

## Poll question responses

Have you used any online laboratories as part of teaching your course?



Do you think that virtual labs can be used instead of real physical lab experimentation?

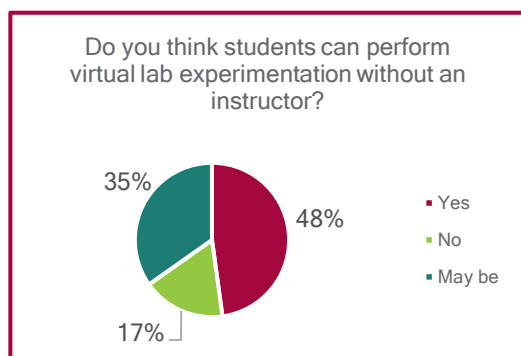
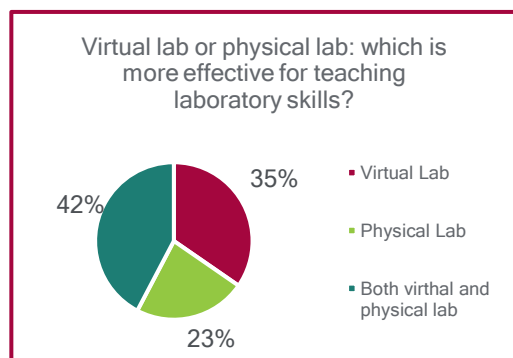


## Hands-on task result

As part of the workshop, there were several tasks assigned so that participants could practice virtual labs and submit the answers. Around 10 minutes were provided to complete the task and submit the answer through polls. Participants who could not submit the correct answer were

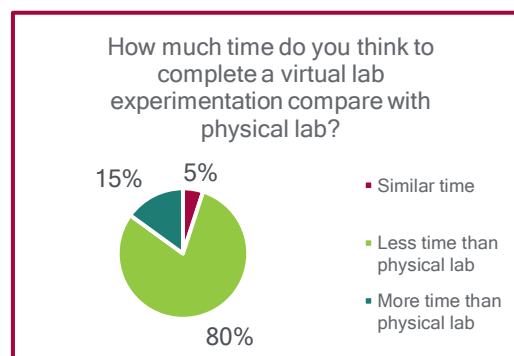
encouraged to repeat the experimentation at their own pace as part of the assignment after the online session.

### Poll question responses



### Hands-on activities with responses submitted through polls

Hands-on task	% of correct responses
Identify the organic compound-13 by using its boiling point in the experiment – Boiling point of an organic compound	62%
What is the pH value of lake water	82%



## Valedictory session

The concluding and valedictory session was graced by the presence of Prof. Madhu Parhar; Director CEMCA; Dr. Shiffon Chatterjee, Senior Programme Officer, CEMCA; Mr. Kok Cheang Loh, Director of the Centre for Learning & Teaching at HELP University. During the valedictory session,



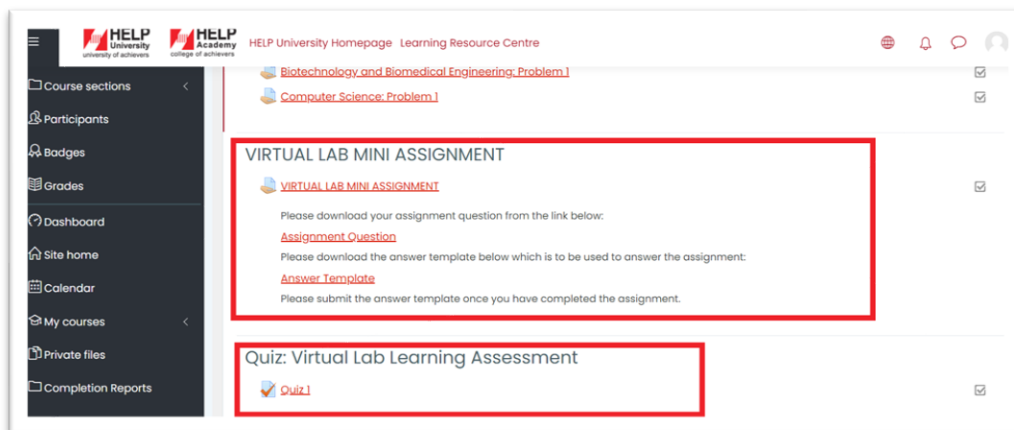
participants express their feedback and suggestion. Mr. Loh delivered the vote of thanks and concluded the session.



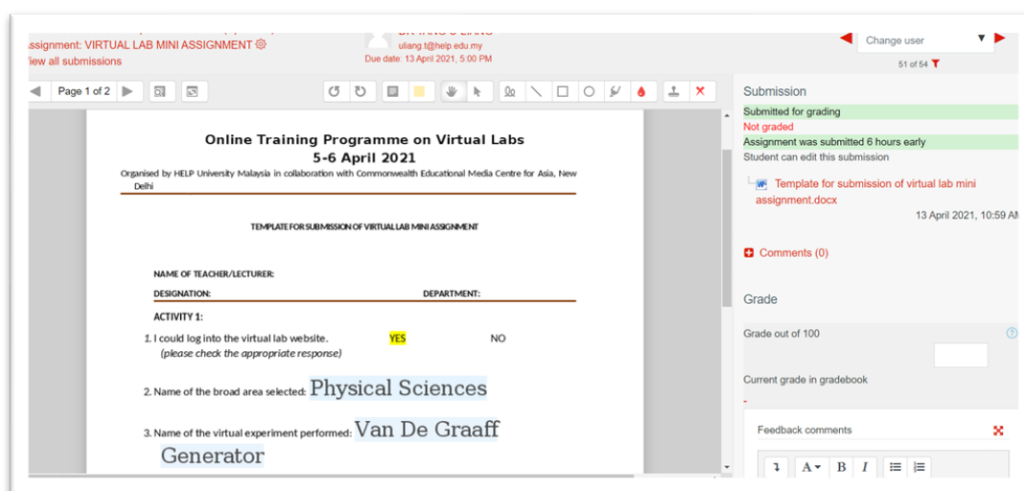
*Valedictory session*

## Mini- Assignment

Mini-assignments and quizzes were provided so that participants could familiarize themselves with how to implement virtual labs as part of the curriculum. These assignments and quizzes were uploaded to the HELP University LMS platform.



*Mini-assignment and quiz shared in the LMS platform*

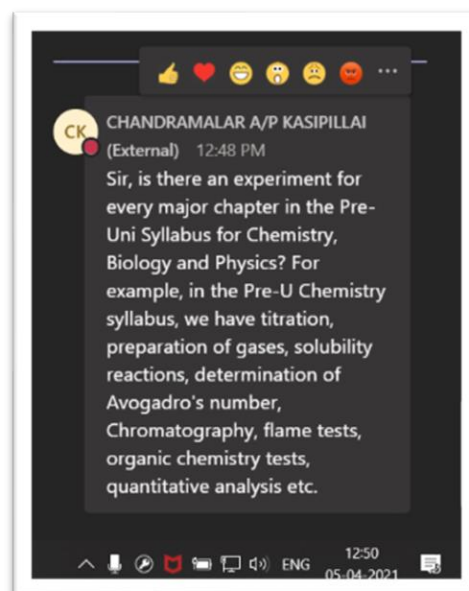


*Mini-assignment submission by the participants*

## Participant's reflections on virtual labs

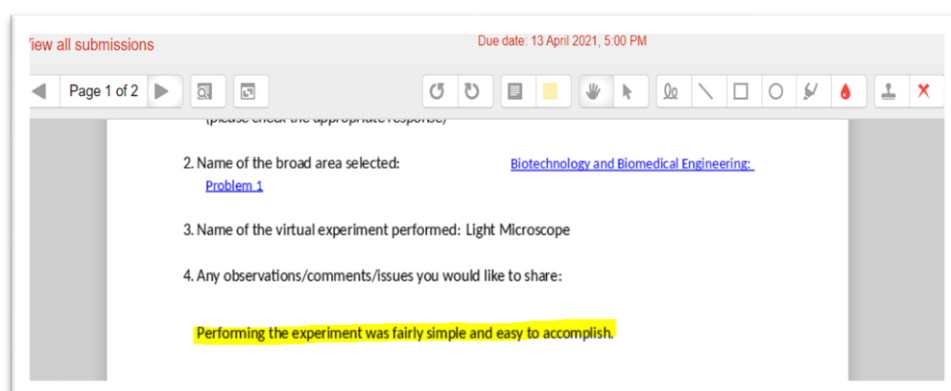
During the workshop, participants engaged with the learning and hands-on exercise activities. Feedback from the audience revealed their reflection upon the hands-on exercise and content given in the virtual lab platform. Participants' interaction with the resource person during the workshop showed their enthusiasm to locate and perform experiments in their field of interest. The meeting chat presented here represents one such feedback from the audience during the first day of the workshop.

All the participants were encouraged to perform the mini assignment in order to get a hands-on experience of the platform. Assignment submission reveals that the participants got an opportunity to clarify their doubts and they were able to access and perform the virtual experiments.



*Interaction during the workshop*

Screenshots of some of the experiments performed and submitted by participants are presented below along with their viewpoint regarding virtual lab experiments.



DESIGNATION: Tutor DEPARTMENT: Psychology

ACTIVITY 1:

1. I could log into the virtual lab website.  YES  NO  
(please check the appropriate response)

2. Name of the broad area selected: Chemical Sciences (Inorganic Chemistry Virtual Lab)

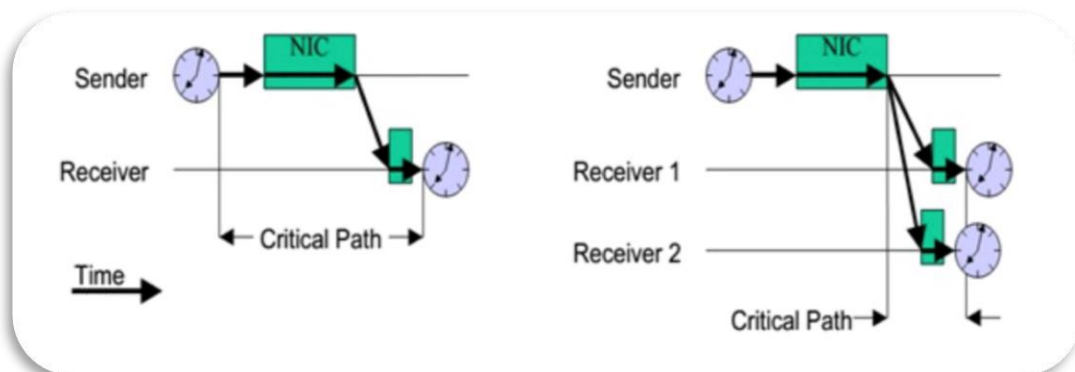
3. Name of the virtual experiment performed: Water Analysis - Determination of Physical Parameters

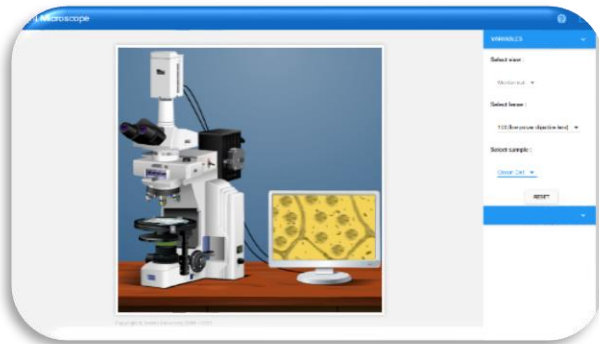
4. Any observations/comments/issues you would like to share:

- It is a quick and simple experiment to try out, especially with the various water samples to enable comparisons of pH levels. I do not need to even worry about having to source and collect the water samples myself, especially given the current situation.
- I like how the animation is really clean and simple, especially the small vibrating movements with the water in the beaker. This may seem like a small matter, but it is some form of virtual interaction with the apparatus rather than just a picture form.
- First-timers may need to play around with the functions in order to figure out how

*Feedback in the mini assignment submitted in the LMS platform.*

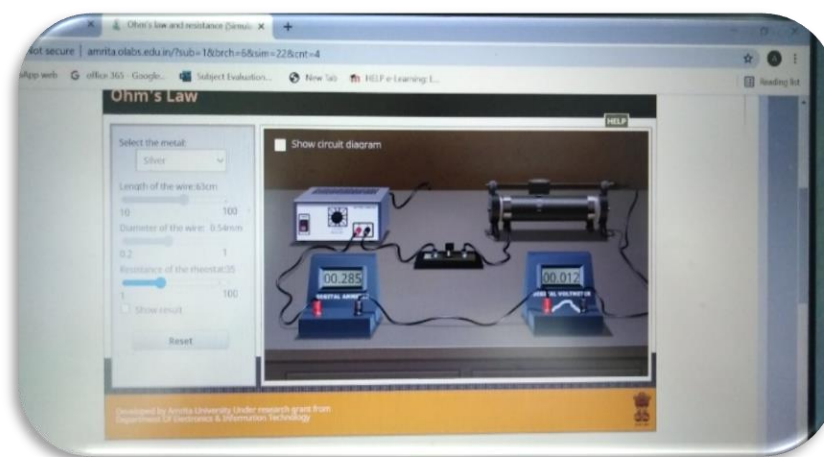
I have learnt that in networks where the range is relatively small, the propagation time is negligible. The reference beacon is claimed to arrive instantly at all the receiving nodes. The only problem for error is receiver insecurity by removing the sender and propagation insecurity. This concept is well shown and described in Figure 2.





A good and easy way of introducing the difference between the lenses that are used in a microscope.

I found that some of the virtual experiments are related to the A level physics syllabus. If the link can be shared to students, they could perform the selected virtual experiment themselves and discussions on the outcomes of the virtual experiments could be discussed during physical class.



## Suggestions from participants

- While hands-on sessions were incorporated to enhance learning, it would be good to have more time for further practice.
- More number of experiments at pre-university level would be helpful.

# Appendices

## Appendix 1: List of participants

### Acronyms

ACE(ADTP) = American Canadian Education (American Degree transfer Programme)

SICT = School of Information Communication Technology

HMC = HELP Matriculation Centre

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