Virtual Labs

**Making Engineering & Science education
 engaging, effective, immersive and online**

January 2017

Virtual Labs

1. Reaches out to Students and Teachers in Engineering and Science Colleges with Virtual experiments
2. Accessible anywhere, anytime, and is free
3. Effective reference material and 'Self Learning Tool'
4. Enhances students performance in exams
5. Improves competency and confidence

Experiments done in Physical Labs are available in Virtual Form.
They are Available Accessible Asynchronous Anywhere Anytime (A^5)

Virtual Labs – e-learning

Global Trends

1. Educational budgets in developing and under-developed countries continue to shrink [2]
2. e-learning and open-learning programs are gaining popularity [2]
3. e- learning through lectures alone have proved to be insufficient
4. Practical skills imparted through experiments enhance overall competence
5. Virtual Labs simulates practical experience with related theories and testing.
6. Online statistics indicates that virtual lab users have been increasing in India suggests increasing usage trends in times to come [3]

"Virtual and open learning initiatives are poised to bring a dramatic change in science education but cannot completely substitute existing educational institutes or hands-on practical laboratory courses" [2]

Importance of a Lab

A lab is a critical component of engineering education.
Science and engineering is a study of natural phenomena. This requires students to work in a laboratory to promote discovery and creativity.

About Virtual Labs

IIIT, HYDERABAD

Virtual Labs Engineering
and Architecture Division

Virtual Labs project is an initiative of MHRD, GoI, under the National Mission on Education through ICT (NMEICT).
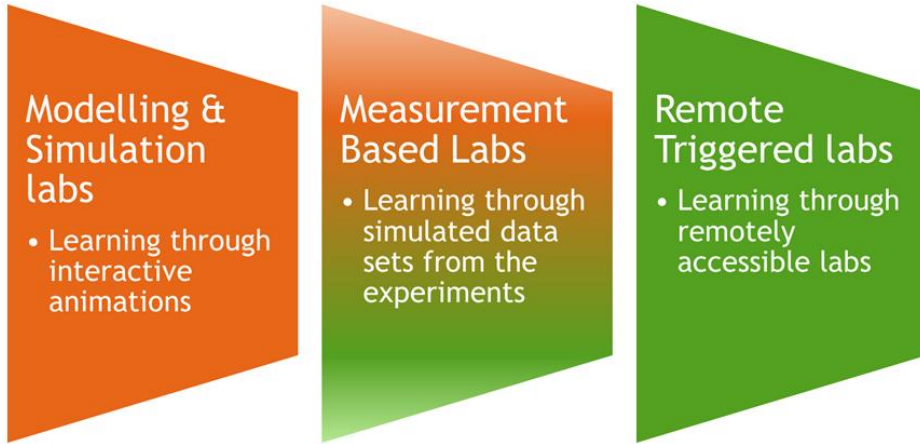
Virtual Labs aims to benefit:

❑ All students and faculty of Science and Engineering Colleges - who may not have access to good laboratory infrastructure

❑ High-school students - to motivate them to take up higher studies and research

❑ Researchers across institutions - to collaborate and share equipment as well as resources

❑ Engineering colleges - who can use the rich content and teaching resources

All Experiments are accessible from this site- http://www.vlabs.ac.in with 185 Active Labs and 31 upcoming.

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3 types of Labs

Modelling & Simulation labs
- Learning through interactive animations

Measurement Based Labs
- Learning through simulated data sets from the experiments

Remote Triggered labs
- Learning through remotely accessible labs

Virtual Labs is a Joint Effort of 12 Partner Institutes

Partner Institutes

IIT Delhi	IIT BOMBAY	IIT Kanpur	IIT Kharagpur	IIT Madras	IIT Roorkee
IIT Guwahati	IIIT Hyderabad	Amrita University	Dayalbagh	NIT Karnataka	COE Pune

Spread of Labs- 10 Domains & over 185 Labs

Domains — **# of labs in each Domain**

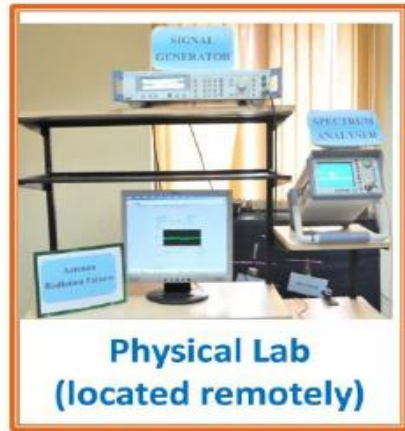| Domain	# of labs
Other Domains	9
Civil Engineering	14
Physical Sciences	14
Chemical Sciences	14
Biotechnology & Biomedical Engineering	29
Chemical Engineering	7
Mechanical Engineering	23
Electrical Engineering	18
Computer Sciences and Engineering	26
Electronics & Communications Engineering	31
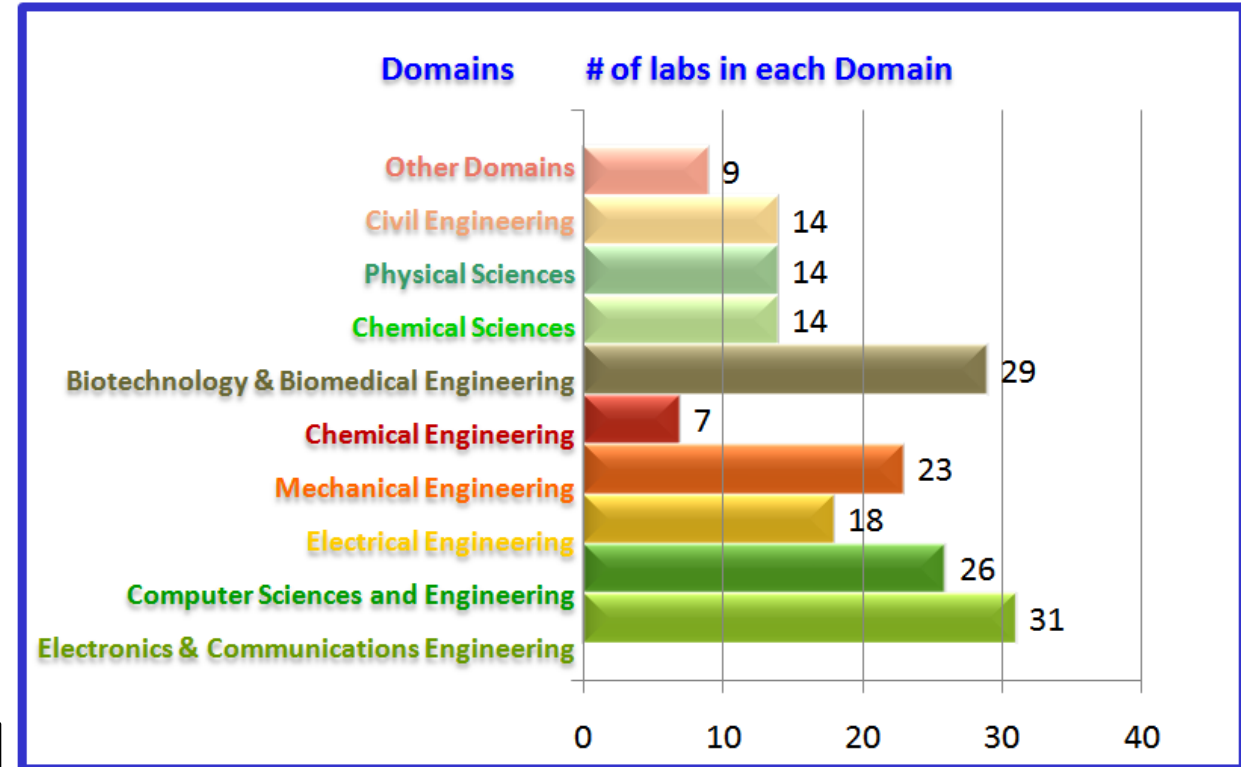
These labs are on Open edX platform.
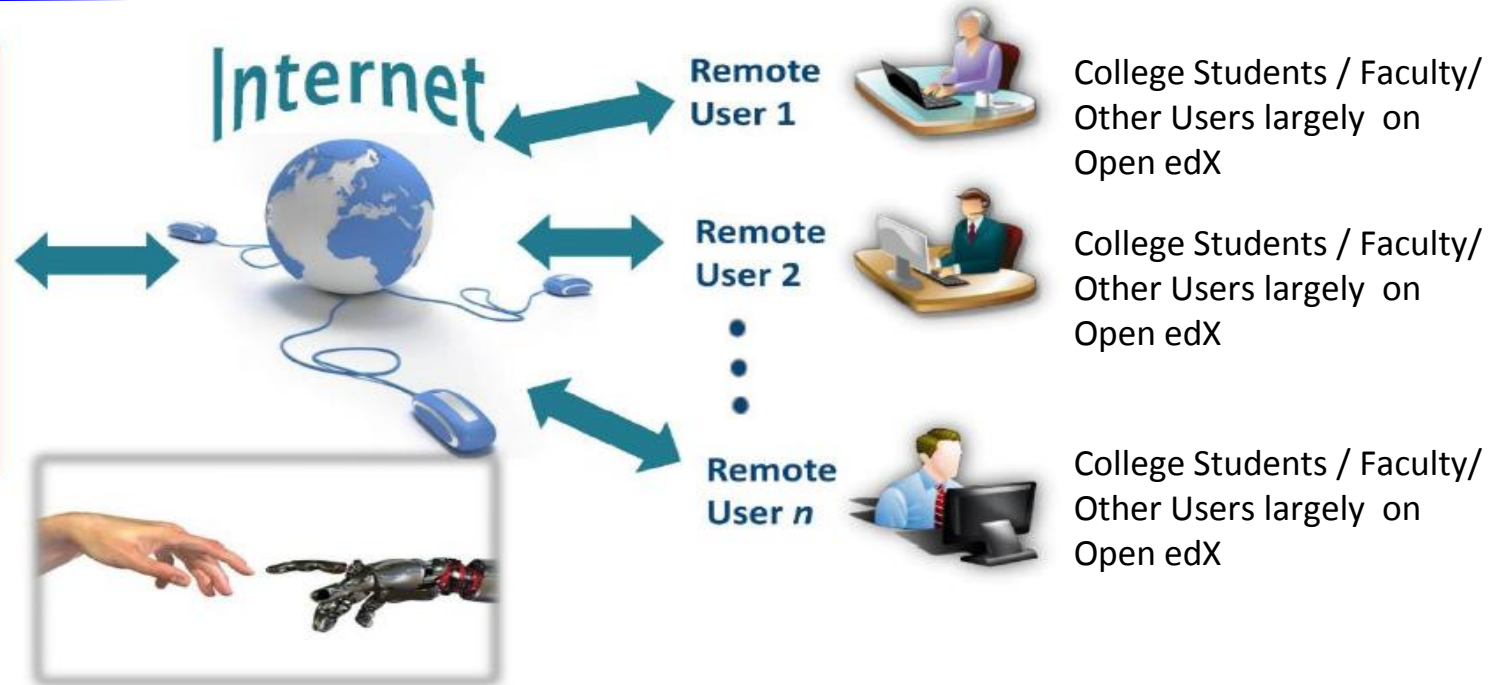An integrated set of experiments that form a "Learning Management System" (LMS)

5

Virtual Labs - Usage Architecture

185 Labs, 1500+ Experiments from 12 Institutes

15,88,000 Usages, 77100 Students, 325 Nodal Centers

Physical Lab (located remotely)

Institute Developed Experiments / Labs on Cloud (AWS)

Internet

Remote User 1 — College Students / Faculty/ Other Users largely on Open edX

Remote User 2 — College Students / Faculty/ Other Users largely on Open edX

Remote User *n* — College Students / Faculty/ Other Users largely on Open edX

Virtual Labs – Relevance to Policy

Virtual Labs is a Project under the NMEICT of the Ministry of MHRD covered under Section 3.14 of the Mission document -"Development and Realization of Virtual Laboratories and supporting facilities for e-learning" [1]

Indian Government Policy on Engineering Education

1. It seeks to bridge the digital divide, the gap in the skills to use computing devices for the purpose of teaching and learning among urban and rural teachers/learners in Higher Education domain
2. Aims to empower those, who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

Focus of e Learning

1. appropriate pedagogy for e-learning
2. **facility of performing experiments through virtual laboratories**
3. on-line testing and certification
4. on-line availability of teachers to guide and mentor learners
5. utilization of available Education Satellite (EduSAT) and Direct to Home platforms
6. training and empowerment of teachers to effectively use the new method of teaching learning etc.

access

equity   quality
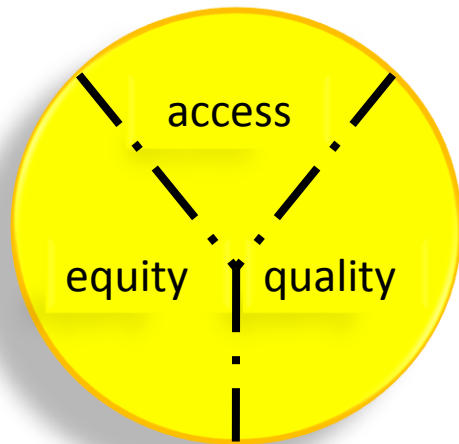
Connectivity, Low cost devices, E- content

Technology Enabled Learning

1. *"National Mission on Education through Information and Communication Technology- Mission Statement " Section 3.14. http://www.aicte-india.org/downloads/Mission_Document.pdf*

Virtual Labs - Impact
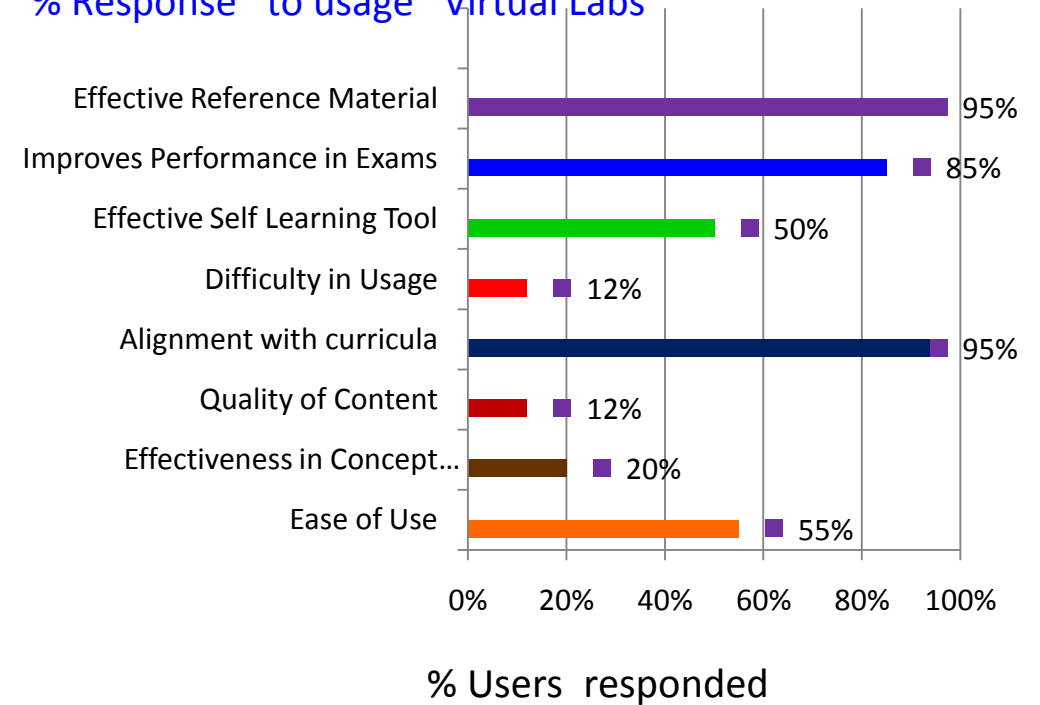
Faculty Perception of Virtual Lab Usefulness
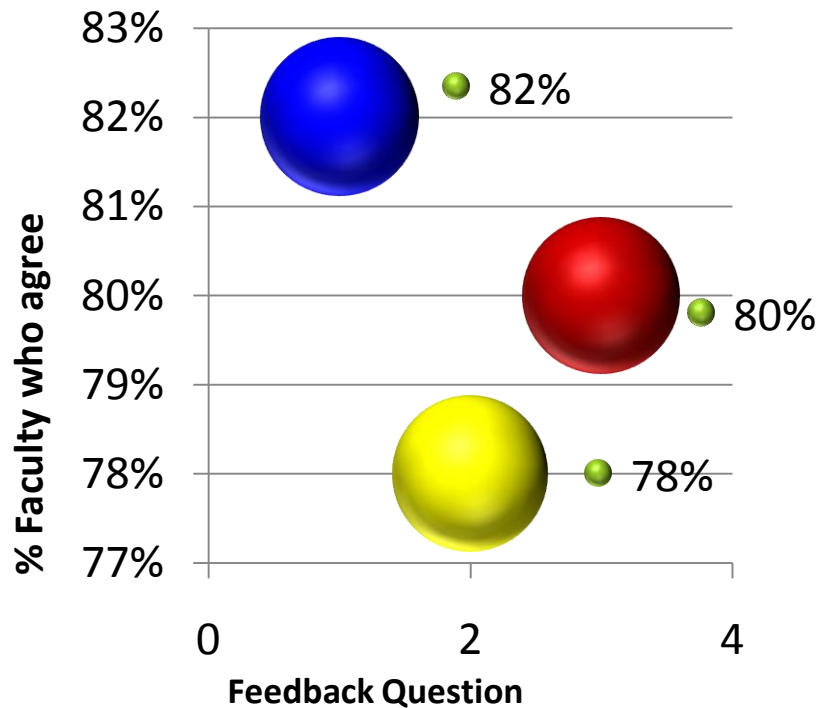
Feedback Questions

1. Virtual Labs can be a supplementary tool and reduce Teacher Effort

2. Effective in Overcrowded class rooms due to easy access

3. Interest in using Virtual Labs for continuous evaluation and final exams
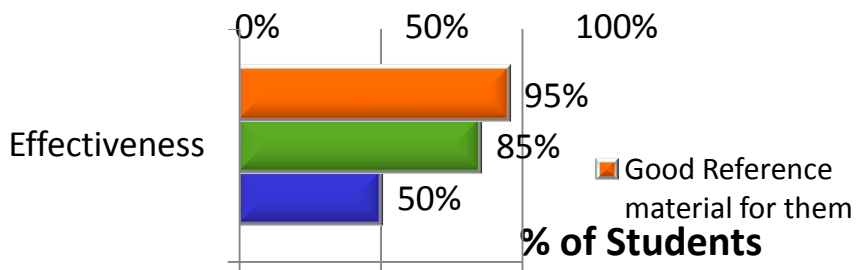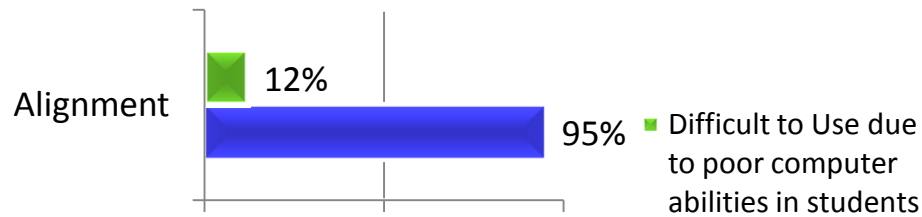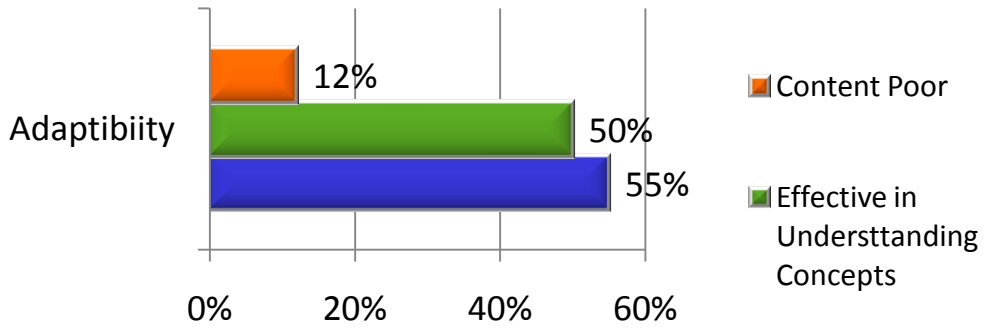
Student Perception of Virtual Lab Usefulness

% Response to usage Virtual Labs

% Users responded

Results based on survey samples of 250 students [2] and another on 50 teachers and 100 students sample [3]

Virtual Labs - Impact

IIIT, HYDERABAD

Virtual Labs Engineering and Architecture Division

Feedback from Students

■ Content Poor

■ Effective in Understtanding Concepts

Adaptibiity: 12%, 50%, 55%

Alignment: 12%, 95%

■ Difficult to Use due to poor computer abilities in students

Effectiveness: 95%, 85%, 50%

■ Good Reference material for them

% of Students

% of Students

Typical Reuse Preferences of Students

- Mother Theresa College of Engg
- Nagole Institute of Technology
- Guru Nanak Institute of Technology
- Average Values

	Want to reuse	See opportunity at personal	No Opinion or commitm	Don't want to reuse	Dummy

Intent to Reuse

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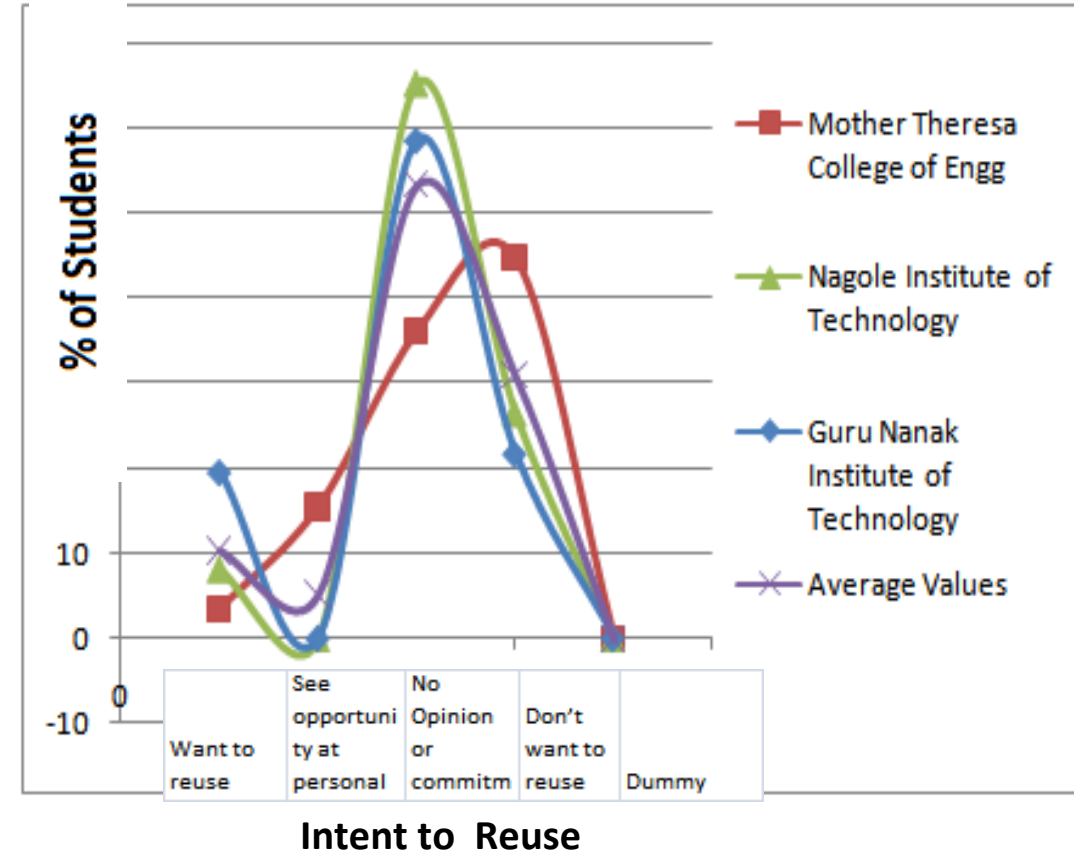
Impact - Outreach

Outreach done through Nodal Agencies through Workshops in colleges across the Country:

- 15.88 Lakh Usages from 77114 students, 327 Nodal Centers, 727 Workshops.
- Labs completely linked to NPTEL
- Recorded in the National Digital Library for posterity
- Labs and Outreach being prepared for rapid growth - spread over colleges, Usages and alignment of experiments to the needs of colleges
- Labs are accessible on Mobile Platform , On Open edX and with Single Sign on

Target Usages and Actual Usages
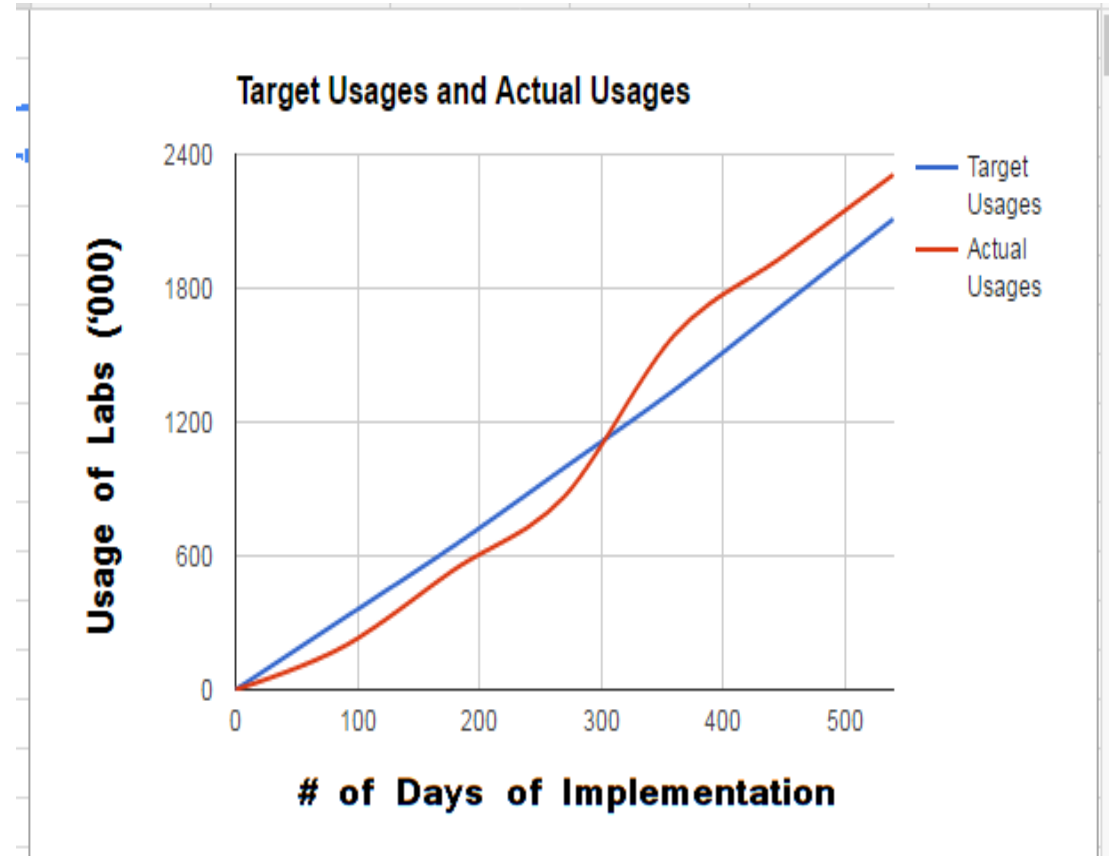
Data from Virtual lab Outreach Logs as on December 2016 [4]

Impact – Outreach Network

Virtual Labs uses the Outreach Model to Evangelize and enthuse students

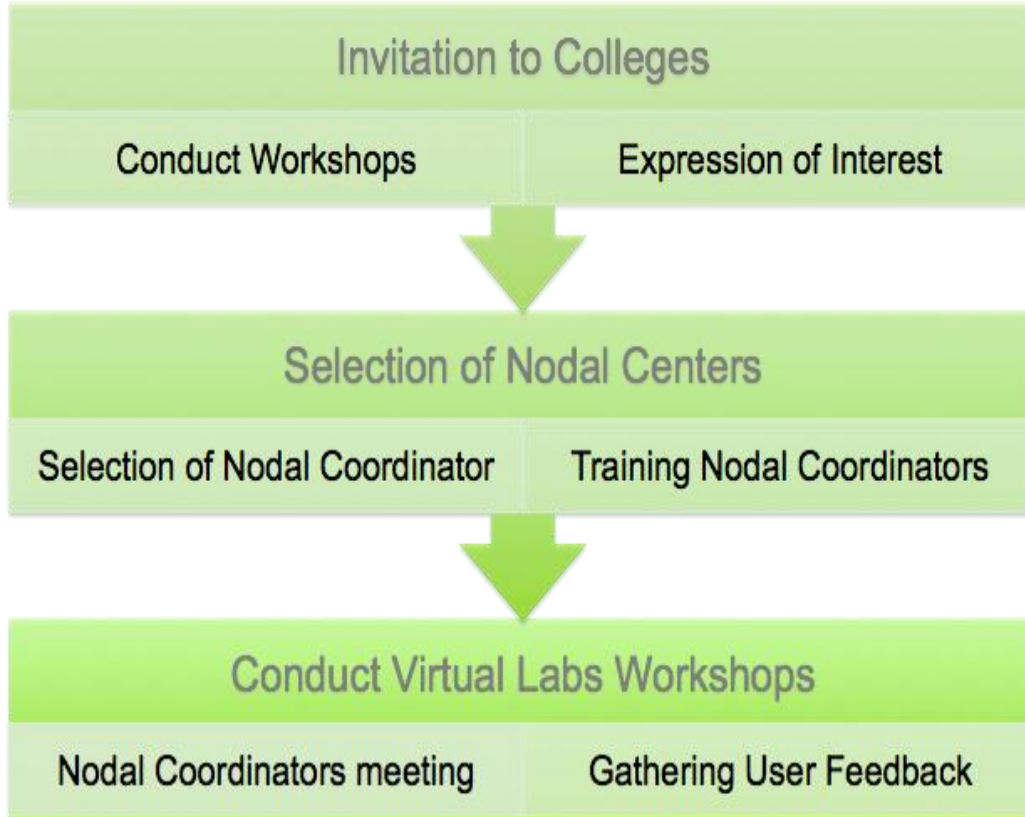Engage private agencies (Nodal Centers) for outreach of Virtual Labs and enthuse students:

1. **Build awareness** about labs and usage
2. Provide **a minimum level training** to **the local faculty members/research scholars** in the colleges, through on-site **workshops**
3. College faculty engage their students in using the virtual labs.
4. identify the gaps in syllabi of universities & existing labs
5. Facilitate additional labs/experiments to fill these gaps.

Faculty and Institutes are facilitated to develop labs
College Clouds to overcome Internet Availability issues – Under development

Outreach - Partners with Virtual Labs

Become a Nodal Center

Invitation to Colleges
Conduct Workshops | Expression of Interest

Selection of Nodal Centers
Selection of Nodal Coordinator | Training Nodal Coordinators

Conduct Virtual Labs Workshops
Nodal Coordinators meeting | Gathering User Feedback

Benefits of a Nodal Center

1. College will be on the National Map of MHRD's ICT Projects

2. Technical & financial support for training students, conducting workshops & developing own customized experiments

3. Students can undertake development projects as their academic project.

4. As a Nodal centre, the college will be helping other colleges & schools nearby to spread the knowledge through ICT.

Virtual Labs

References

1. *"National Mission on Education through Information and Communication Technology- Mission Statement " Section 3.14. http://www.aicte-india.org/downloads/Mission_Document.pdf*
2. Sandipan Ray, Sanjeeva Srivastava, Bipin Nair and Shyam Diwakar[3]'E-learning resources and virtual labs', Nature India Special Issue: Proteomics Research in India , doi:10.1038/nindia.2015.114 Published online 27 August 2015
3. Shayam Diwakar etal, 'Usage and Diffusion of Biotechnology Virtual Labs for Enhancing University Education in India's Urban and Rural areas', from the book '' E-Learning as a Socio-cultural System: A Multidimensional Analysis ", A volume in the Advances in Educational technologies and Instructional Book Series, Published by Indformation Science Reference 2014 (http://www.igi-global.com)
4. Raman, R. *et al.* The VLAB OER Experience: Modeling potential-adopter student acceptance, *IEEE Education* **57**, 235-241 (2014) doi: 10.1109/TE.2013.2294152 (2015).
5. Diwakar, S. et al. Complementing neurophysiology education for developing countries via cost-effective virtual labs: Case studies and classroom. Neurosci. scenarios. J. UndergradEduc. 12, A130-A139 (2014).

Thank You!

Access Virtual Labs at:

http://vlabs.ac.in

http://vlab.co.in

Virtual Labs

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Virtual Labs web page: vlabs.ac.in

Technical feedback: engg@vlabs.ac.in

Jobs/internships: jobs@vlabs.ac.in

Contribute to Virtual Labs at:

http://vlabs-dev.vlabs.ac.in/gsoc-2016/ideas-list.html

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