



**Gustavo
R. Alves**

gca@isep.ipp.pt



Ensino prático à distância com base
em laboratórios remotos e virtuais

1º Objetivo

Contribuir para melhorar o ensino e a aprendizagem em Engenharia, através de novas pedagogias e tecnologias.

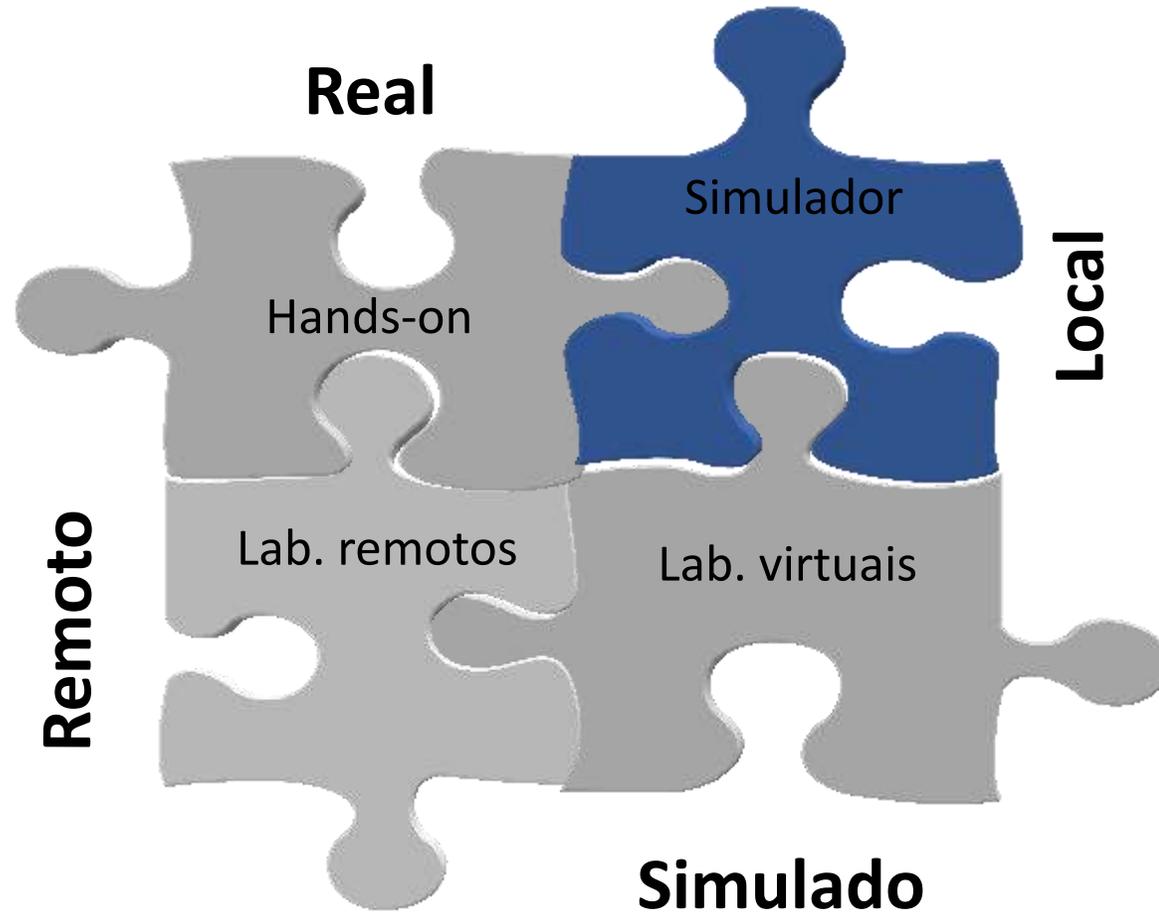
- Os laboratórios remotos e virtuais constituem uma tecnologia educativa
- Existem diferentes metodologias pedagógicas para o uso de laboratórios remotos e virtuais, que contribuem de distintas maneiras para a melhoria do processo de ensino e aprendizagem.

2º Objetivo

Permitir aos alunos fazerem mais experimentos

- Os laboratórios remotos permitem realizar experimentos reais, à distância
- Os laboratórios virtuais permitem realizar experimentos simulados, à distância
- Estão normalmente acessíveis 24 horas por dia, 7 dias por semana, a partir de qualquer dispositivo ligado à Internet

Laboratórios presenciais (*hands-on*), remotos e virtuais (simulação)



- Critério
 - Tipo de acesso
 - Local
 - Remoto
 - Natureza
 - Real
 - Simulada
- Comp. experimental vs. tipo de lab.
 - [Soysal \(2000\) – Eng. Elétrica](#)
 - Ma & Nickerson (2006)

Recursos: Laboratórios remotos e virtuais

PARTICIPATING INSTITUTES

- IIT DELHI
- IIT BOMBAY
- IIT KANPUR
- IIT KHARAGPUR
- IIT MADRAS
- IIT ROORKEE
- IIT GUWAHATI
- IIT HYDERABAD
- AMRITA UNIVERSITY
- DAYALBAGH UNIVERSITY
- NIT KARNATAKA
- COE PUNE

Labs developed by Nodal Centers

NODAL CENTERS

Announcements

University, **COEP** has been successfully completed on August 27, 2016.

-> State-level workshop on Virtual Labs at Global Institute of Management & Emerging Technologies, Amritsar has been successfully completed on Feb 21, 2017.

-> State-level

LAB FEEDBACK FORM

LAB ASSESSMENT FORM

FAQ

SHAKSHAT PORTAL

Contact Us
support@vlab.co.in

Online Labs

The **Go-Lab Portal** aims at supporting teachers and students in their inquiry learning activities offering a wide range of online tools to work on scientific problems in a virtual environment. Using the Portal, teachers can utilize online laboratories and supporting learning applications to build inquiry Learning Spaces customized for a certain class.

The **online laboratories** offered by Go-Lab can be remotely-operated or virtual. **Remote labs** can be used by the students to gather data from a real physical laboratory setup, including real equipment, from remote locations. Those labs include, for example, the **WetsLab-DELISTO-Aquarium**, whose main learning objective is the Archimedes' Principle. There, students can throw balls filled with different liquids in an aquarium using a web interface to observe different buoyancy behaviors. Another example is the **Fishbowl Telescope** that offers a database of astronomical pictures as well as the opportunity for the students to remotely operate the telescope and to take their own pictures of the cosmos.

The other kind of online labs are **virtual labs**. They enable the students to simulate real equipment and experiments. Virtual labs include, for instance, **Galaxy Clash** simulating collisions of galaxies to make it possible to compare them to students' predictions that are made in advance for the experiment; **LHC Game** simulating the whole process of a particle accelerator like the Large Hadron Collider used at CERN; and **Solbox**, the virtual buoyancy laboratory in which students can learn in a virtual way about Archimedes' Principle simulating the same experiment as conducted with the remote Aquarium lab described above.

Quick Links

- Go-Lab Summer School
- Go-Lab Teacher Contest
- Big Ideas Challenge
- Go-Lab Online Course
- Instructions & Support
- Go-Lab Newsletter

Next-Lab Project

Next-Lab (Next Generation Stakeholders and Next Level Ecosystem for Collaborative Science Education with Online Labs) is a European research project co-funded by the European Commission in the framework of the **Horizon 2020 Programme**. Next-Lab focuses on introducing inquiry-based science education (IBSE) in schools and continues the mission of the project **Go-Lab**, promoting innovative and interactive teaching methods in primary and secondary schools.

Next-Lab provides a varied portfolio of advanced online learning tools in science topics, which contains hundreds of virtual and remote science laboratories, inquiry learning applications and Inquiry Learning Spaces. Furthermore, there is an authoring tool for teachers they can use to create own cross-curriculum learning scenarios and share them with their students.

Using Next-Lab, students benefit from the rich, challenging learning experiences, shaping their science and technology knowledge together with social competencies. The innovative tools of Next-Lab guide students through the research process, helping them to acquire in-depth understanding of scientific topics as well as 21st century collaboration and reflection skills.

Remote Labs

Enriching digital education

Wind Tunnel
To allow students to visualise and measure parameters associated

Engineering Mechanics & Materials Rig

Labshare Channel
Click here to see additional videos the experiments in action

The Labshare Institute

The Labshare institute was wound up by mutual agreement in early 2015. This website, the rig catalogue and the Labshare helpdesk are now maintained by the UTS remotelab group. Please submit requests for trials, feedback and support requests as per instructions 'getting started'. If you require UTS remotelab consulting services, please proceed as for 'support' but change the subject line to 'request consulting services'.

Partnered with:

- UNIVERSITY OF TECHNOLOGY SYDNEY
- Curtin University
- University of South Australia
- RMIT UNIVERSITY

As seen in:

- ABC Catalyst

About | Catalogue | Resources | Remote Labs | Getting started

TLI People Services Partnerships Sectors | Rig catalogue Lesson catalogue Library | Community Publications Newsroom | About Benefits | Getting started Support Feedback

labshare

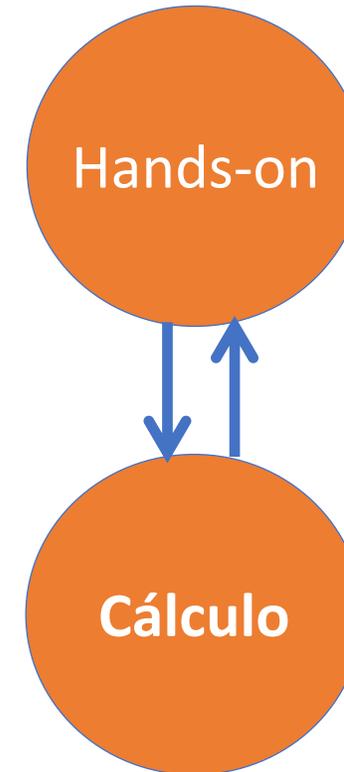
Copyright 2014 The Labshare Institute, ABN 44 152 103 734. All rights reserved. For assistance click here.

EE: Modelo ensino/aprendizagem

Royal Society motto 'Nullius in verba' (1660):
"... express the determination of its Fellows ... to verify all statements by an appeal to facts determined by experiment."

Max Planck: *"An experiment is a question which science poses to Nature and a measurement is the recording of Nature's answer."*

Lyle Feisel (2005): *"The value of combining theory and practice traced back to the 1st engineering school in the US, the US Military Academy, founded at West Point, NY in 1802."*



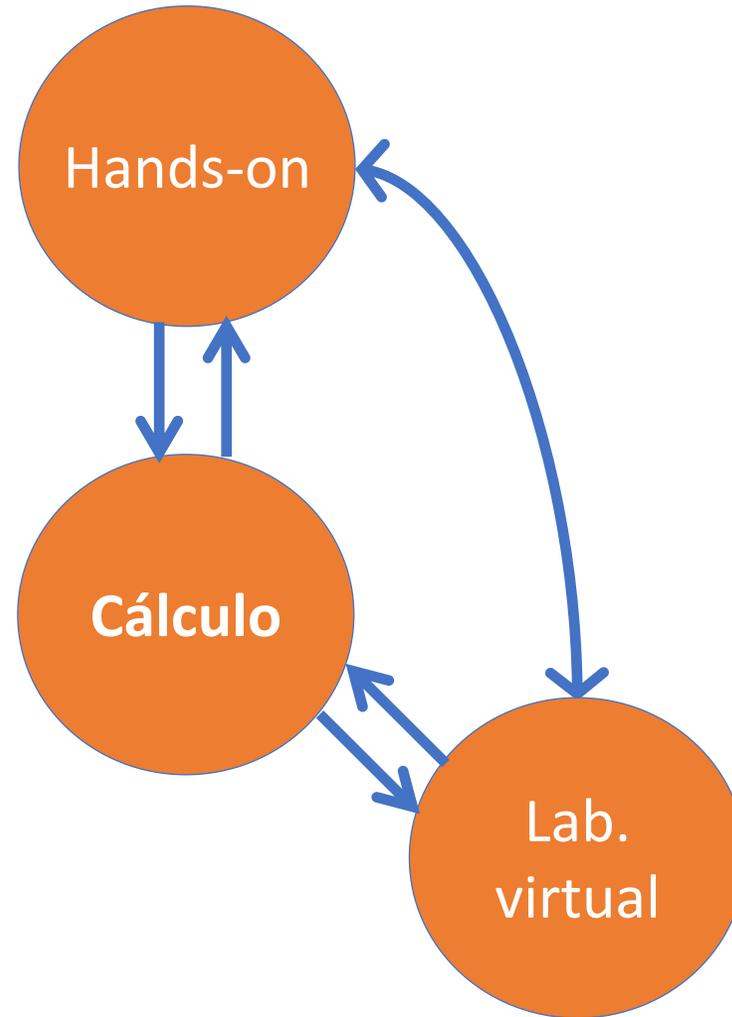
Primeiras Escolas de Engenharia
Séc. XVIII

EE: Modelo ensino/aprendizagem

Séc. XX - Anos 70-80

Um novo ator:

O computador pessoal!



Simulações em
computador

Meados do Séc. XX

Um PC por bancada
laboratorial

Finais do Séc. XX
Inícios do Séc. XXI

EE: Modelo ensino/aprendizagem

Instrumentação controlada por computador

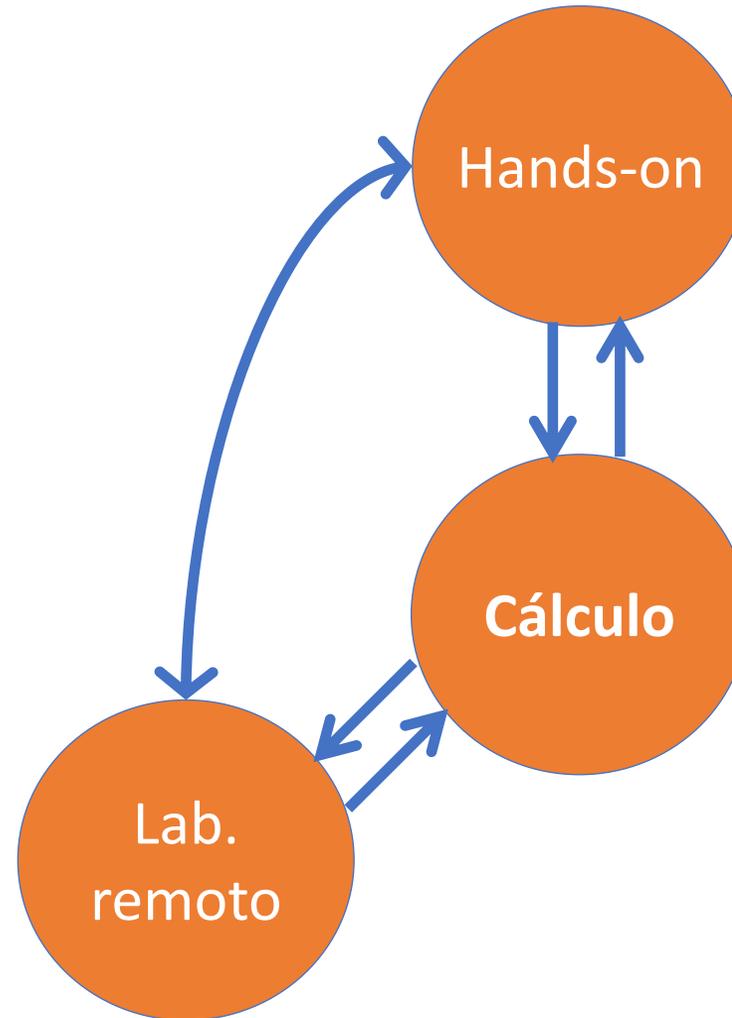
Séc. XX - Finais dos anos 60

Controlo via Internet

Séc. XX - Década de 90

Second-Best to Being There (SBBT)

Aktan, Bohus and Shor (1996)



GPIB



EE: Modelo ensino/aprendizagem

[Hands-on, simulated, and remote labs: A literature review](#)

Ma and Nickerson (2006)

[Developing the TriLab](#)

Abdulwahed and Nagy (2010)

[Learning outcome achievement in non-traditional \(virtual and remote\) versus traditional \(hands-on\) laboratories: A review of the empirical research](#)

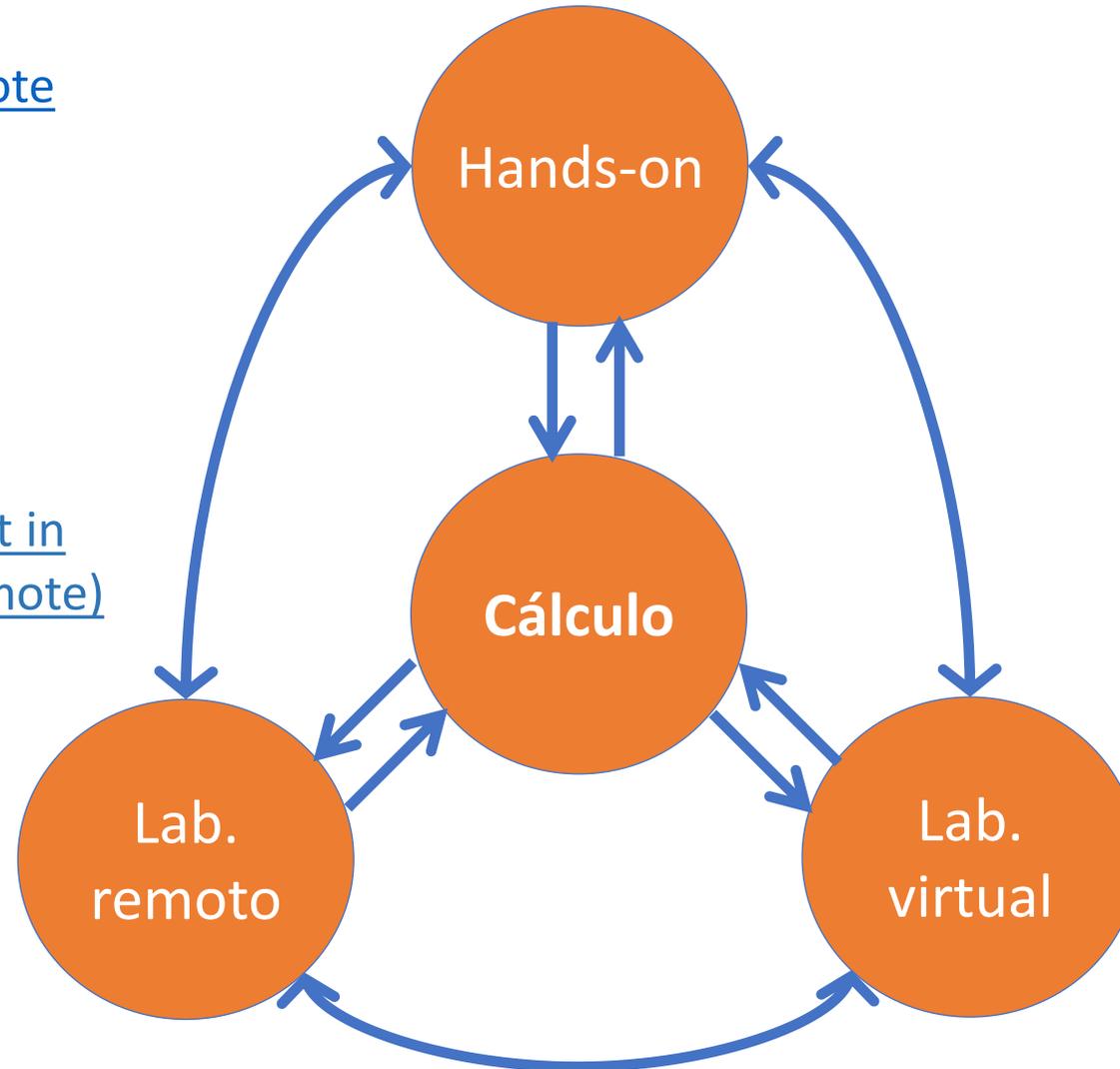
Brinson (2015)

[The Impact of Remote and Virtual Access to Hardware upon the Learning Outcomes of Undergraduate Engineering Laboratory Classes](#)

Euan Lindsay's PhD (2005)

[Weighting and sequence of use of different lab environments in the teaching-learning process](#)

Alves et al. (2008)



Five Major Shifts in 100 Years of EE

1. A shift from hands-on and practical emphasis to engineering science and analytical emphasis
2. A shift to outcomes-based education and accreditation
3. A shift to emphasizing engineering design
4. A shift to applying education, learning, and social-behavioral sciences research
5. A shift to integrating information, computational, and communications technology in education

Froyd, Wankat, and Smith (2012)

Five Major Shifts in 100 Years of EE

5. A shift to integrating ICCT in education

- content delivery: television, videotape, and the Internet
- programmed instruction: individualized student feedback
- personal response systems (clickers)
- computational technologies
- intelligent tutors: second phase of individualized student feedback
- simulations
- games and competitions
- remote laboratories
- grading

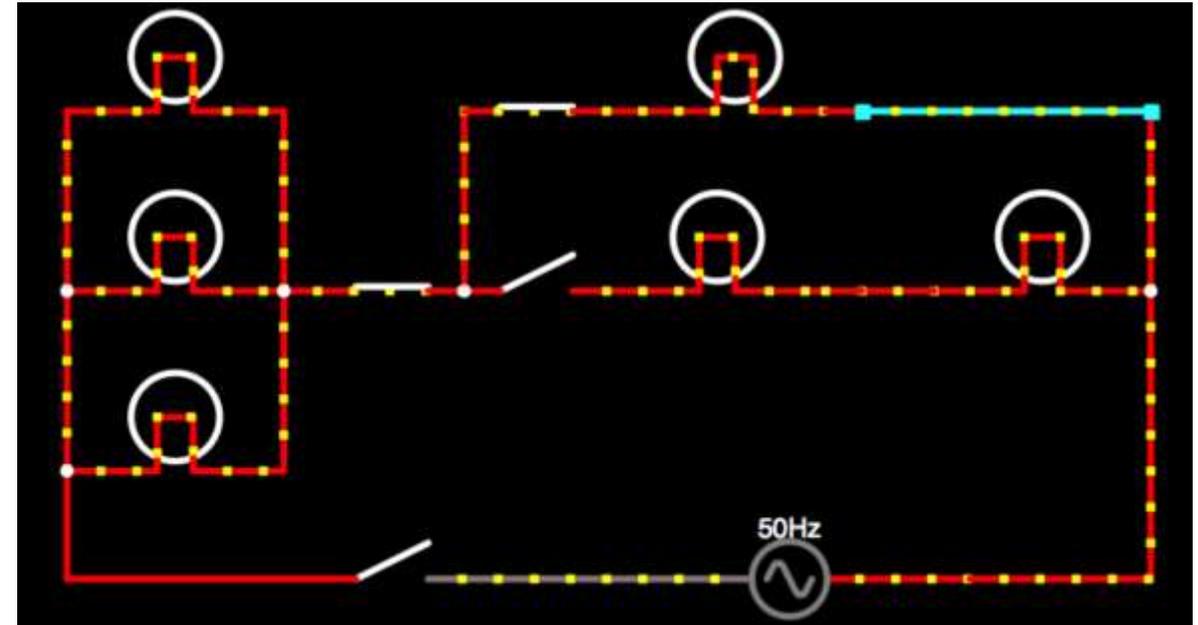
Froyd, Wankat, and Smith (2012)

Estratégia(s) de E&A baseadas em laboratórios remotos e virtuais

- Aspectos a considerar:
 - Plano curricular: objectivos e resultados da aprendizagem!
 - Recursos (materiais, infraestrutura, ambientes disponíveis, etc.)
 - Considerar tempo de aprendizagem / adaptação aos recursos disponibilizados
 - Estilos de aprendizagem e métodos de ensino
 - Diversidade!
 - Feedback constante e rápido.
 - Avaliação
 - Combinar elementos comuns e individuais. Garantir igualdade de oportunidade e níveis aproximados de dificuldade.
 - Promover trabalho colaborativo na fase de aprendizagem e independência de resultados na fase de avaliação (individual)

Estratégia(s) de E&A baseadas em laboratórios remotos e virtuais

- Exemplos na área da Eletricidade: circuito com lâmpadas

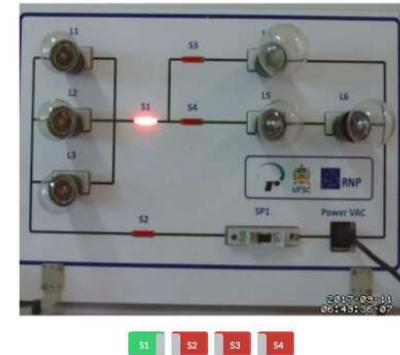


RexLab: UFSC: <http://relle.ufsc.br/labs/2>

Falstad: circuit simulator: <http://www.falstad.com/circuit/circuitjs.html>

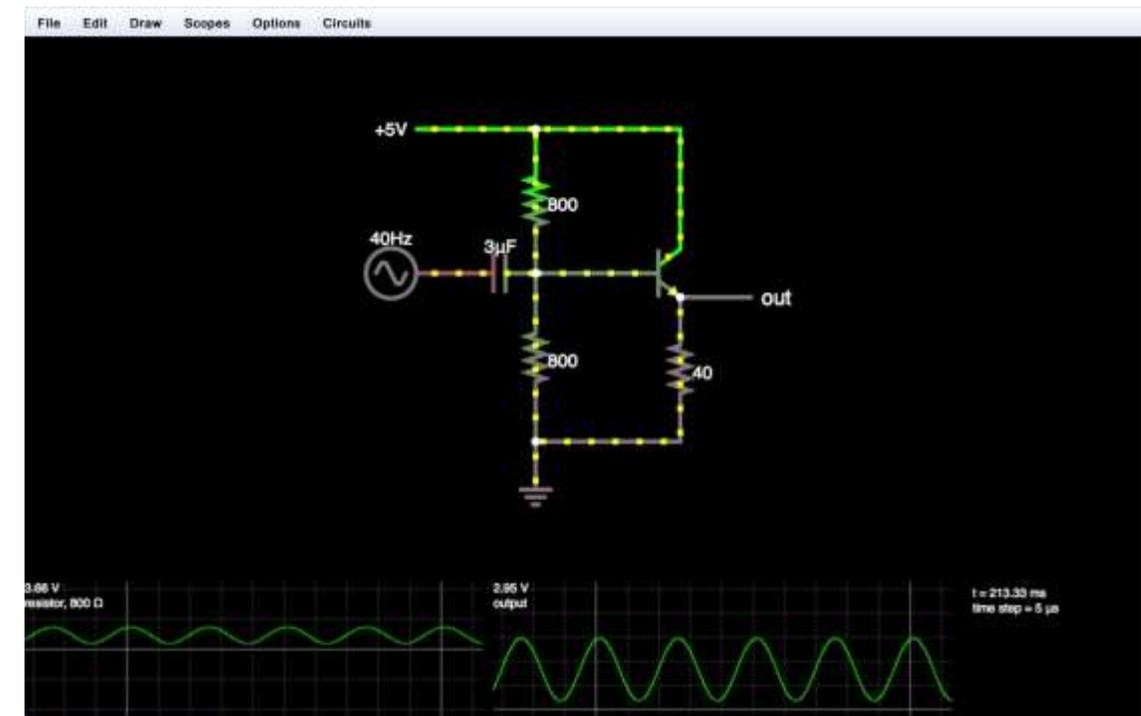
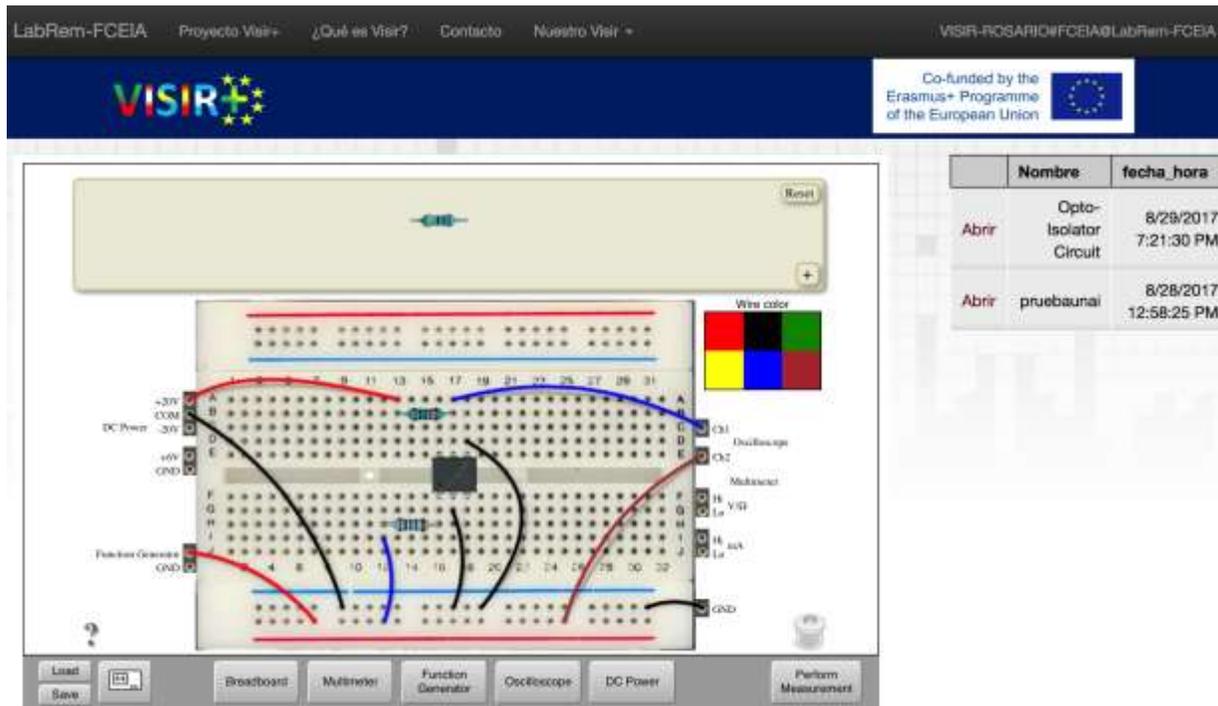
Estratégia(s) de E&A baseadas em laboratórios remotos e virtuais

- Exemplos na área da Eletricidade: circuito com lâmpadas
- Laboratório virtual (manipulação do tempo)(partilha do circuito)
 - <http://tinyurl.com/yb324g47>
- Laboratório remoto (real): realidade dos resultados (modo interativo)
 - A resistência da lâmpada depende das condições do circuito
 - Potência nominal / tensão nominal
 - Tempo de simulação (*time step* = 5 μ s)
- Laboratório real: impossível medir (diretamente) a resistência da lâmpada
- Cálculos: simples (potência | tensão nominal) ou complexos (resistência em função da temperatura do filamento [$R = R_0 \cdot (1 + \alpha \cdot \Delta t)$])



Estratégia(s) de E&A baseadas em laboratórios remotos e virtuais

- Exemplos na área da Engenharia Eletrotécnica: circuitos elétricos e electrónicos



VISIR@UNR: <https://labremf4a.fceia.unr.edu.ar/labs/visirnet/default.aspx>

Falstad: <http://www.falstad.com/circuit/circuitjs.html>

Virtual Instrument Systems in Reality (VISIR)



- Ingvar Gustavsson (inspired in Max Planck):

*“Experimenting could be compared to a conversation with nature. The experimenter asks and nature answers. The tricky thing is formulating a useful question and above all interpreting the answer. The only way to learn the language of nature is performing many experiments in laboratories that can be hands-on **or remote.**”*

Virtual Instrument Systems in Reality (VISIR)



OpenLabs Electronics Laboratory

Login   

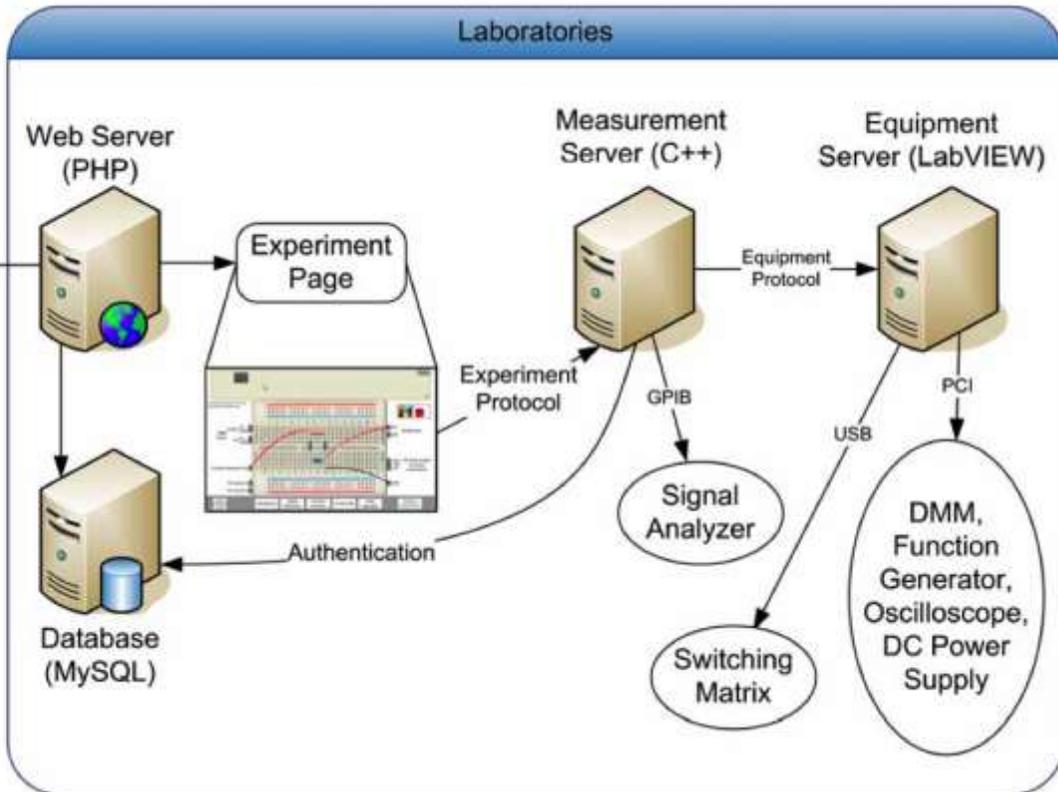
- MAIN MENU**
- Start
 - About
 - Demo
 - FAQ

Welcome

Welcome to the distance electronics laboratory.

Here you will find the resources needed to experiment in electronics via the internet. We have developed a system where you can make electronic experiments, right here in your browser. We supply basic equipment, such as oscilloscope, multimeter, function generator and power supply. With these and a number of electronic components you can build circuits on our virtual breadboard. None of the measurements are simulated. The circuits you build will be formed and measured on, and the real measurement results will be displayed.

Interested? Go to our [demo page](#).

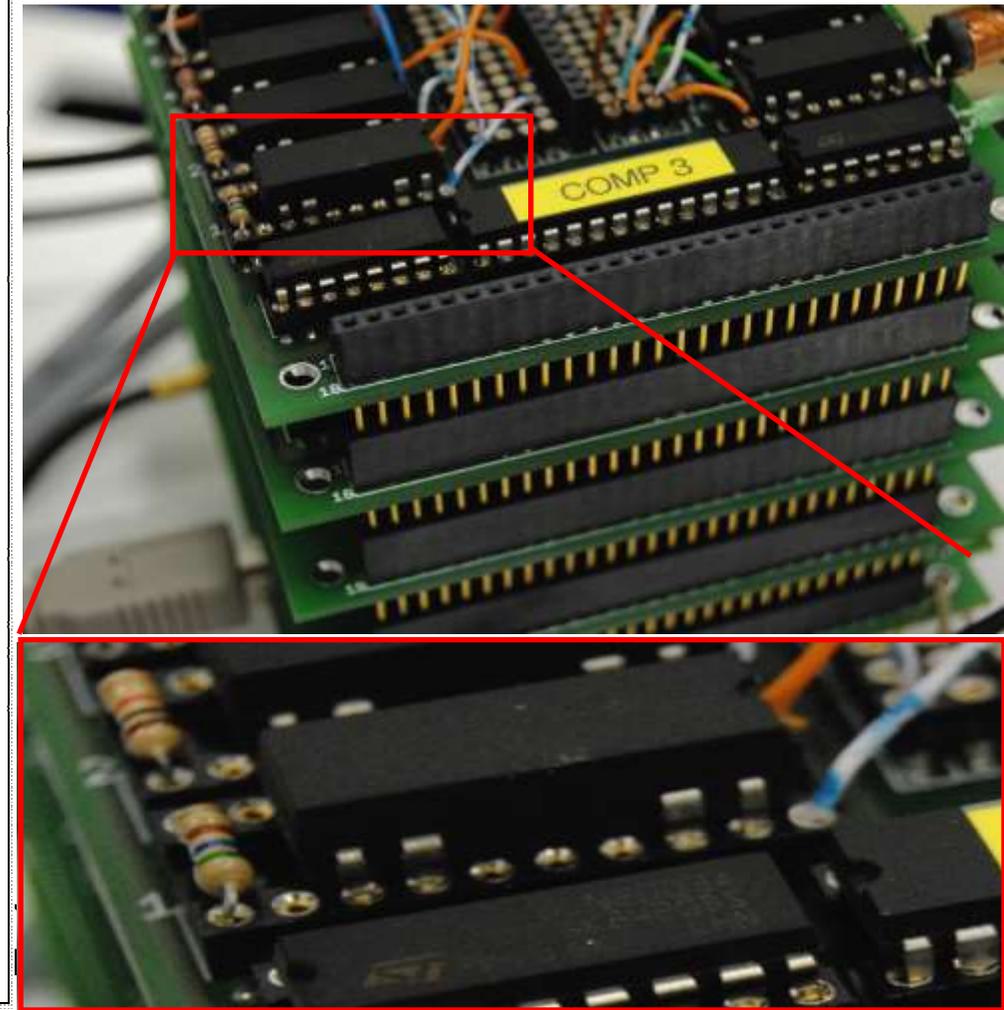


The measurement hardware

If you have any questions about this page or the laboratory, contact the [administrator](#).

Virtual Instrument Systems in Reality (VISIR)

The screenshot shows a virtual breadboard simulator interface. At the top, there is a toolbar with a 'Reset' button and a selection of components including resistors and an operational amplifier. Below this, a text box instructs: 'Hold down and press 'R' to rotate. Use delete to remove wires.' The main workspace is a virtual breadboard with a grid of holes. A DC Power Supply is connected to the top rail (+25V, COM, -25V) and a +6V GND rail. A Function Generator is connected to the bottom rail (GND). A resistor is placed on the breadboard, and a wire connects it to the Ch1 input of an Oscilloscope. Another wire connects the other end of the resistor to the Ch2 input of the Oscilloscope. A DMM (Digital Multimeter) is also connected to the breadboard, with its Hi and Lo terminals connected to the same points as the oscilloscope. A 'Wire color' legend is visible on the right, showing colors for different wire types. At the bottom, there is a toolbar with buttons for 'Save', 'Load', 'Breadboard', 'Multimeter', 'Function Generator', 'Oscilloscope', 'DC Power', 'Perform Experiment', and 'Help'. Below the toolbar, the text 'Prepared experiments: Guest Experiment Operational amplifier' is displayed.



VISIR Laboratories

- Blekinge Institute of Technology (BTH), Sweden (1999)(VISIR+) (PILAR)
- University of Deusto (UD), Spain (2008)(VISIR+) (PILAR)
- FH Campus Wien University of Applied Sciences, Austria
- Carinthia University of Applied Sciences (CUAS), Austria (VISIR+) (PILAR)
- School of Engineering – Polytechnic of Porto (IPP-ISEP), Portugal (2010)(VISIR+) (PILAR)
- National University for Distance Education (UNED), Spain (VISIR+) (PILAR)
- Indian Institute of Technology Madras (IIT-Madras), India
- Batumi Shota Rustaveli State University, Georgia
- Pontifical Catholic University of Rio de Janeiro (PUC-Rio), Brazil (2016)(VISIR+)
- Federal University of Santa Catarina (UFSC), Brazil (2017)(VISIR+)
- Federal Institute of Santa Catarina (IFSC), Brazil (2017)(VISIR+)
- National University of Rosario (UNR), Argentina (2017)(VISIR+)
- National University of Santiago del Estero (UNSE), Argentina (2017)(VISIR+)
- University of Hassan 1st , Morocco
- National University for Distance Education (UNED), Costa Rica ([2018](#))
- Technical University of Dortmund (TU Dortmund), Germany ([2019](#))
- University of Georgia (UGA), GA, USA ([2020](#))



Global Online Laboratory Consortium



The GOLC Online Laboratory Award 2015 in the category

„Remote Controlled Lab“

is presented to

VISIR (Virtual Instrument Systems in Reality)

Submitted by:

Ingvar Gustavsson, Gustavo Alves, Thomas Fischer, Javier Garcia Zubia, Felix Garcia, Manuel Castro

Awarded during the 12th International Conference on Remote Engineering and Virtual Instrumentation (REV2015) in Bangkok, Thailand

Abul K. M. Azad
President

Michael E. Auer
Secretary General



GOLC – Mission Statement

"The mission of the consortium is the creation of sharable, online experimental environments which increase the educational and scientific value of learning which may not be accessible, scalable or efficient through traditional methods."

This means especially:

- to encourage and support the creation of new online labs and associated curricular materials;
- to sponsor the design of an efficient mechanism for sharing, exchanging and trading access to online labs by creation of a global network of shareable experiments;
- to support communities of scholars created around online laboratories; and
- to lead the evolution of an architecture that enables the sharing of online labs by unified standards.

GOLC

About GOLC

Leadership

Members

Membership

Mailing Lists

Online Lab Award

Latest News

Prof Ingvar Gustavsson receives SEFI Francesco Maffioli Award for teaching excellence

[Home](#) > [Blog](#) > [Highlight](#) > Prof Ingvar Gustavsson receives SEFI Francesco Maffioli Award for teaching excellence

🕒 2 October 2018 📁 Highlight

Prof Ingvar Gustavsson receives SEFI Francesco Maffioli Award for teaching excellence

The SEFI Francesco Maffioli Award of Excellence for Developing Teaching and Learning in Engineering Education is the European cup in Engineering Teaching. This year the Award went in memoriam to Prof Ingvar Gustavsson from Blekinge Institute of Technology.

Prof. Ingvar Gustavsson won the award for his contribution in using remote experiments using Virtual Instrument System In Reality, (VISIR). He started developing the remote lab in 1999, at the Blekinge Institute of Technology (BTH). His goal was to allow students to freely perform available experiments, while learning about electric and electronic circuits. Prof. Gustavsson's vision enables students freely perform experiments, either locally or remotely.

Recent posts



This was SEFI 2018 Annual Conference

2 October 2018



SEFI joins Engineers Europe Advisory Group

3 October 2018



Best Paper of SEFI 2018 Annual Conference

2 October 2018

A etapa em curso | Futuro

- Criação de federações de Laboratórios Remotos
- Evolução do modelo de negócio associado
 - Aumento da oferta e da procura
- Laboratórios remotos = parte da missão das Instituições de Ensino Superior
- Amadurecimento de algumas tecnologias associadas
 - Realidade virtual combinada com acesso a equipamento real (e.g. jogos digitais)
 - Modelos híbridos (virtual | remoto)
 - Dispositivos hápticos | percepção de odor | etc.

Conclusão

- A integração de laboratórios remotos e virtuais no contexto de uma unidade curricular depende de vários aspectos:
 - Individuais: a vontade do responsável da UC (professores) e o grau de adesão dos alunos e alunas
 - Institucionais: disponibilização de recursos e suporte à sua integração
- Objectivos:
 - dotar os alunos de mais e melhores competências experimentais
 - permitir a realização de mais experiências de forma sustentável



Gustavo R. Alves
IPP – ISEP - CIETI
gca@isep.ipp.pt

isep Instituto Superior de
Engenharia do Porto



Obrigado pela atenção!

Co-funded by the
Erasmus+ Programme
of the European Union



SERCET 2020 "Semana de Educação à Distância para Ciências Exatas e Tecnológicas"
10 a 14 de agosto de 2020, 14:00 – 17:00

Mandamentos da experimentação remota

1

Autor: Javier García Zubía, Universidade de Deusto, Espanha

Ama mais os teus serviços de TIC do que os teus experimentos remotos. O laboratório remoto que quiseres usar não deverá nunca comprometer os serviços de TIC da tua instituição de ensino. É muito difícil, para não dizer impossível, que o pessoal técnico atenda a razões educativas. Fala com eles antes de fazer o que quer que seja, e dá-te bem com eles!!

Tradução livre de Gustavo R. Alves



Mandamentos da experimentação remota

2

Autor: Javier García Zubía, Universidade de Deusto, Espanha

Sê profissional ao escolher um laboratório remoto. Deves ter a certeza que o experimento remoto vai funcionar e deves escolher apenas laboratórios remotos profissionais: confiáveis e de qualidade. Tu não necessitas de explicações quando algo não funciona durante a aula; tu necessitas que funcione sempre (ou quase sempre).

Tradução livre de Gustavo R. Alves



Mandamentos da experimentação remota

3

Autor: Javier García Zubía, Universidade de Deusto, Espanha

Pensa no curriculum e acertarás. Na aula, o experimento remoto deve atender a um dado objetivo ou competência da tua disciplina ou curso, seja de que tipo for, por exemplo: compreender a lei da gravidade ou praticar inglês.

Tradução livre de Gustavo R. Alves



Mandamentos da experimentação remota

4

Autor: Javier García Zubía, Universidade de Deusto, Espanha

O curriculum é do professor, não do projetista. Não permitas que quem projetou e construiu um experimento remoto te dê lições académicas, se não estás de acordo com elas. O experimento deve convencer-te a ti. Tu não deves convencer a ninguém dos teus conhecimentos.

Tradução livre de Gustavo R. Alves



Mandamentos da experimentação remota

5

Autor: Javier García Zubía, Universidade de Deusto, Espanha

Domina tu a ferramenta e não o contrário. Um experimento remoto pode alterar a forma de dar aula e isso levar-te-á tempo e reflexão, porém nunca debes ir muito atrás da ferramenta.

Tradução livre de Gustavo R. Alves



Mandamentos da experimentação remota

6

Autor: Javier García Zubía, Universidade de Deusto, Espanha

Protege os alunos do teu sentido de inovação: não acrescentes pratos ao menu, sem sentido. Não continues fazendo o de sempre na aula para logo depois acrescentar o teu toque final; isso cansará e distrairá o aluno. Escolhe o que é bom para o aluno e para a disciplina.

Tradução livre de Gustavo R. Alves



Mandamentos da experimentação remota

7

Autor: Javier García Zubía, Universidade de Deusto, Espanha

Os alunos não são cobaias para os experimentos. Não uses os experimentos remotos para obter dados dos alunos de maneira indiscriminada. Esta é uma atividade típica das universidades: usar os alunos para outros fins.

Tradução livre de Gustavo R. Alves



Mandamentos da experimentação remota

8

Autor: Javier García Zubía, Universidade de Deusto, Espanha

O experimento deve ajudar e não ser um desafio em si mesmo. Em alguns casos as interfaces dos experimentos remotos são tão complicadas que anulam o seu efeito educativo. O aluno dedica mais tempo ao seu uso que à sua utilidade, o que desvaloriza o experimento e o professor que o usou.

Tradução livre de Gustavo R. Alves



Mandamentos da experimentação remota

9

Autor: Javier García Zubía, Universidade de Deusto, Espanha

Todos os alunos são nativos digitais. Para um aluno, a informação digital é tão real com a analógica ou a natural. A Internet é real para eles, assim tenta que o experimento seja de qualidade e imersivo, e não te preocupes porque razão o aluno está imerso, pois está.

Tradução livre de Gustavo R. Alves



Mandamentos da experimentação remota

Autoria:

Javier García Zubía
Universidade de Deusto
Espanha

Tradução livre:

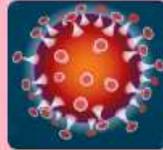
Gustavo R. Alves
Politécnico do Porto
Portugal



SERCET 2020 "Semana de Educação à Distância para Ciências Exatas e Tecnológicas"
10 a 14 de agosto de 2020, 14:00 – 17:00

Laboratórios remotos: menu

- <https://labsland.com/en>
- <https://www.golabz.eu/>
- <http://www.remlabnet.eu/>
- <https://relle.ufsc.br/>
- ...



COVID-19 announcement

If you are a high school, college or university that has been affected by COVID-19, you can qualify to have a **free subscription** until the end of September 2020.

[View more information](#)

Labs Land

Real laboratories, on the Internet



Remote Labs



Try the labs



For your educational center

- ***.... from Dr. Tony Bates, former director of Distance Education and Technology in the Continuing Studies Division, University of British Columbia, Canada. He is now a part-time professor at the Universitat Oberta de Catalunya (UOC), in Barcelona.***
- ***... extracted from the elearningeuropa.info portal. Interview with Tony Bates, professor at UOC, by David Segarra, content manager. Title: “e-Learning should be used strategically and not just as a tool that everybody uses”. Placed: 30 Dec 2004.***

- ***What would be your recommendations for universities that wish to begin to be involved in e-learning?***
 - ***I think universities have to go through stages of development. The first one is what I would call the lone rangers, individual people enthused by the technology, working on their own and experimenting. The second stage is when the lone rangers start putting pressure on the university administration to provide help and resources. That's followed by a third stage of rapid uncoordinated activity, and lots of things happening all over the place and lots of problems as a result. That leads to the fourth stage, which is focus, policies and priorities. At that stage the institution starts thinking strategically: What are the best areas for e-learning? What policies should we put in place? What technical and educational support do professors need? The fifth and last stage is the sustainable and high quality use of e-learning in selected areas or for specific target groups.***



- ***What would be your advice for institutions that are at various points on this path?***
 - ***I think most institutions are at the third stage of uncoordinated activity. My advice would be to put a process in place. By this, I mean setting up a committee to look at policies and priorities and to produce some kind of plan for e-learning. And, secondly, make sure you're getting in the necessary support staff on a full employment basis. One of the big problems is we get programmers and instructional designers hired on contract. They do a good job, they start learning and then the contract runs out and they go and get a job somewhere else. So it's important to have some human resource policies in place and a career structure for these people.***

- ***What is more important, the policies prepared by the institution or the willingness of individual professors?***
 - ***It's both a top-down and a bottom-up process. The institution needs to set some strategies. But it has to come from the professors too. If the academics don't want to do e-learning, it's not going to happen.***