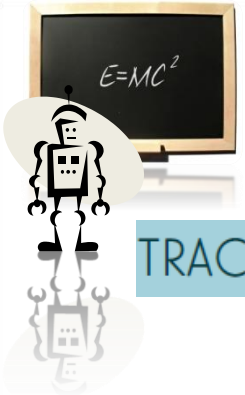

TRACK 12. EDUCATIONAL INNOVATION

TEEM'16
TECHNOLOGICAL ECOSYSTEMS FOR ENHANCING MULTICULTURALITY

VISIR´s Usage as an Educational Resource: a Review of the Empirical Research

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Presentation Structure

- Introduction
- VISIR Remote Lab
- VISIR Literature Review Methodology
- Analysis and Results
- Discussion and Conclusion

Introduction

- Engineering Education has solid needs of experimental competence development:
  - ✓ traditionally these were developed in laboratories
  - ✓ nowadays simulation and remote labs allow students to practise differently
- Each method allows the development of different competences.

Introduction

Student learning outcome achievement is equal or higher in NTL (Non Traditional Labs) versus TL (Traditional Labs)

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"Blended" or hybrid approach is being advanced: a combination of TL and NTL

Introduction

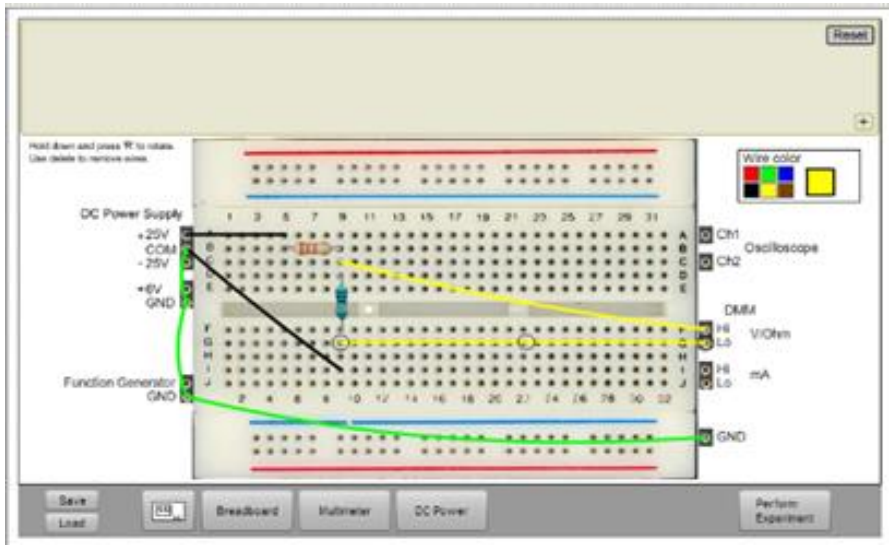
- Students must be aware of the major differences in the type of measurements:
  - ✓ computation model results from simulation
  - ✓ real experimental results from remote labs

- Remote Lab: an educational resource, in which the user and the experimental apparatus are physically apart.

VISIR Remote Lab

- VISIR (Virtual Instrument Systems in Reality), started in 1999, at the BTH, Sweden.
- Launched on March 2004

- For creating, wiring and measuring electronic circuits on a breadboard remotely



VISIR Remote Lab

- Installed in eight HEI in 6 countries (Sweden, Portugal, Austria, Spain, Georgia and India)
- BTH research group is still responsible for maintaining and updating VISIR
- Special Interest Group (SIG VISIR): foster the collaboration within the community and to foment the project dissemination
- In 2015, VISIR was recognized as the best remote controlled laboratory
- VISIR is the first remote lab to serve a MOOC on industrial electronics

Research Question

Understand and systematize the scientific research using VISIR´s approach, done so far

Research Question

Considering VISIR implementation and usage reported in literature until May 2016, which common outcomes and indicators of consistent results can be found in the different didactical approaches?

Literature Review Methodology

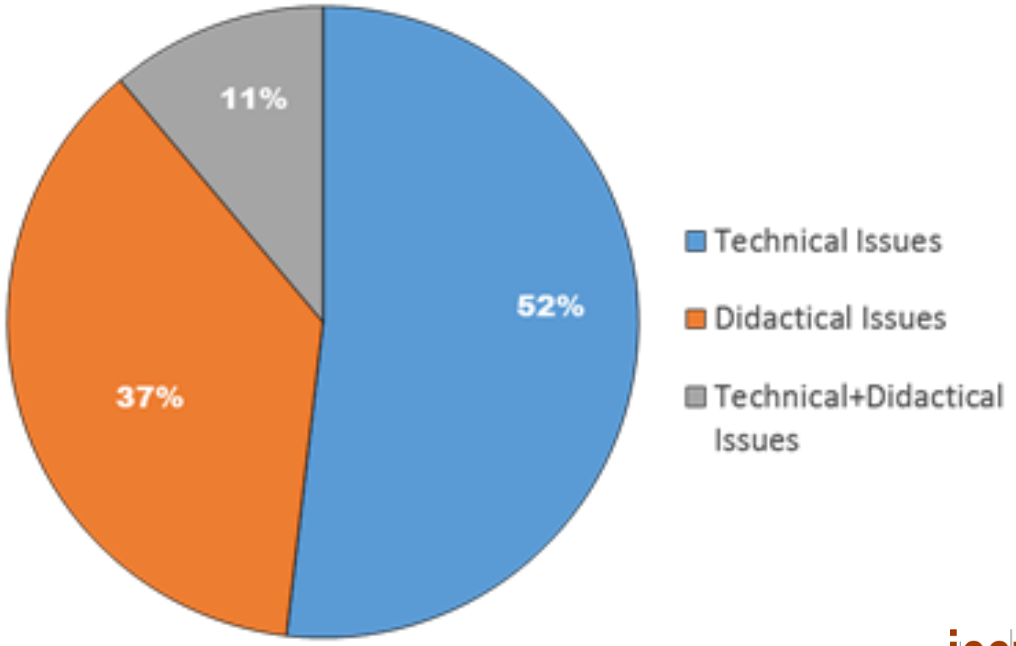
- A systematic literature review:
  - ✓ B-on Electronic data base
  - ✓ Researchers working with VISIR
  - ✓ Two major conferences on online/remote labs field: REV and EDUCON

- 54 papers were full-text reviewed and coded

Literature Review Methodology

Technical Issues (**TI**): software/hardware components description and other technical items

Didactical Issues (**DI**): VISIR implementation and usage in a specific course



Literature Review Methodology

- Technical Issues were briefly addressed
- Didactical Issues – Multicase Study Approach
  - 22 Courses:
    - ✓ more than 4400 students
    - ✓ different educational levels
    - ✓ Knowledge level
    - ✓ type of intervention

Literature Review Methodology

Course type	Academic Year	Students	Educ. Level	Interventions /Semester	Papers
B	2010/11	561	Hig	6 weeks	[14]; [52]; [7]; [19]; [56]; [68]; [22]
S	2010/11	49	Hig	All semester	[7]; [21]; [20]
B	2010/11	574	Hig	All semester	[8]; [21]; [20]
S	2010/11	47	Hig	All semester	[7]; [21]; [20]
S	2010/11	68	Hig	All semester	[7]; [21];[20]
S	2010/11	345	Hig	All semester	[7]; [21]; [20]
B	2010/11	189	Hig	3 weeks	[7]; [21]; [20]
S	2013/14	79	Hig	All semester	[64]; [65]; [66]
S	2013	15	Voc	NI	[61]; [20]
S	2013/14	71	Hig	NI	[57]; [62]; [20]
B	2009/10; 2010/11	94	Sec	7-8 weeks	[16]; [20]
S	2014/15	35	Hig	NI	[69]
S	2008/09; 2009/10	NI	Hig	NI	[19]; [53]; [68]; [20]
S	2008/09; 2010/11	NI	Hig	3 Pratical Sessions	[19]; [53]; [67]; [68]; [20]
S	2010/11	NI	Hig	NI	[19]; [53]; [68]; [20]
S	2009/10	40	Voc	2 days	[19]; [63]; [68]
S	Since 2010	NI	Voc	NI	[19]; [68]
B	2013/14	53	Hig	NI	[53]; [55]; [58]; [60]
B/S	Since 2003	NI	Hig	NI	[67]
S	2013/14	NI	Hig	NI	[23]
S	2013	2200	Voc	NI	[23]; [24]
NI	2012/13	NI	Hig	NI	[59]

Analysis and Results

- Each case analysed in 4 dimensions:
  - ✓ Intervention Description
  - ✓ Research Analysis
  - ✓ Educational Goals
  - ✓ Reached Conclusions

Intervention Description

Intervention Description	Cases
No desrciption	C10, C12, C19, C20, C21
Brief Description	C1, C2, C3, C4, C5, C6, C7, C9, C11, C13, C14, C15, C16, C17, C18, C22
Detailed Description	C8

- **No Description** (23%): VISIR was used mainly to test and evaluate its capacity and to perceive students' opinion about it
- **Brief Description** (73%): period of time of VISIR usage, where it was used, if it was mandatory or optional, its' contribution to final grade, used in groups or individually, type of supervision, …
- **Detailed Description**: one course developed based on the usage of four different resources: calculus, simulation, VISIR and hands on both in class and assessment

Type of Research Analysis

Research Analysis	Cases
Qualitative	C9, C10, C11, C12, C13, C14, C15, C16, C17
Qualitative and Quantitative	C1, C2, C3, C4, C5, C6, C7, C8, C18, C22
No reported Data	C19, C20, C21

- **Qualitative** (41%): mainly surveys/questionnaires and interviews/observations both to students and/or teachers; lab reports, writing assignments and exams were also used
- **Qualitative and Quantitative** (45%): also the number of accesses to VISIR and other resources, presences in classes and students' grades
- **No Data** (14%): C20 and C21 describe on going experiences; C19 describe its use in BTH

Educational Goals

Educational Goals	Cases
Defined Centered	C2, C3, C7
Defined General	C1, C4, C5, C6, C8, C18
Not Defined	C9, C10, C11, C12, C13, C14, C15, C16, C17, C19, C20, C21, C22

- **Defined Centered**: enfolding VISIR's usage into the learning goals (defining specific tasks using VISIR as a complement to lab work or individual study)
- **Defined General**: providing an extra resource to the course, as a mean to diversify ways of developing competences
- **Not Defined**: finding out if VISIR was a useful resource; not particularly concerned with didactical frameworks

Reached Conclusions

Reached Conclusions	Cases
Gains in development of competences	C1, C13, C14, C15, C19
Gains in students' learning and/or performance	C1, C2, C4, C5, C6, C13, C14, C15, C16, C17 C18, C22
Increment in students' skills problem solving	C3, C8
Increase in students' confidence in lab	C1, C4, C5, C6, C13, C14, C15
Development in critical thinking	C6, C8
Improvement of experimental competences	C1, C7
Increment in students' Motivation and enthusiasm	C1, C8, C16, C17
Useful tool as complement to hands on (and other resources)	C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11 C13, C14, C15, C22
Useful tool for distance learning	C9, C20, C21
More appropriate to introductory courses	C4, C5
Students are satisfied with VISIR	C10, C11, C12, C13, C14, C15, C16, C17
Teacher experience and attention in VISIR plays a crucial role	C1, C2, C3, C4, C5, C6, C7, C13, C14, C15, C18
VISIR engagement is conditioned by the VISIR's contribution to final grade	C2
Students experience difficulties in their initial use of VISIR	C1, C7, C8
Students need time with the teacher (and/or) tutorials	C1, C8, C11

Discussion and Conclusion

- VISIR system is a functional and useful learning instrument, well accepted by students, which should be used as a complement to hands on lab or as a tool for distance learning.
- It improves students' competences and knowledge (59%)
- It increases students' confidence in lab and their enthusiasm and motivation (45,5%)

Discussion and Conclusion

- It´s very difficult to isolate VISIR´s contribution to these results
- Factors that somehow, compromise students' engagement and motivation:
  - ✓ teachers supervision in students' first time with VISIR
  - ✓ teachers continuous attention to VISIR throughout the course
  - ✓ VISIR contribution to the final grade

Discussion and Conclusion

- For the integration design it´s important to set up the VISIR tasks according to the leaning goals and students' knowledge
- Identified one case where VISIR was used with other resources, following an enquiry based methodology; it seems that this methodology enhanced students learning and the development of high order skills

Discussion and Conclusion

VISIR+ Project aims to define a set of educational modules comprising hands-on, simulation and VISIR remote lab together with calculus, following an enquiry-based teaching and learning methodology

+

PILAR Project aims to build the first European federation of VISIR nodes

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FEDERATION OF VISIR LABORATORIES

Questions, doubts, and suggestions (welcomed)

Many thanks for your attention!

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