The iLab Experience -
Making Teaching Better, at Scale

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• Studied Informatics with emphasis on Computer Graphics and Media Science in Tübingen.

• Holds a PhD from Technical University in Munich (TUM, 2014).

• Currently works on his Habilitation at TUM.

• Director Digital Teaching Académie Franco-Allemande.

• Research Focus:

  • Secure and Autonomous Management of Internet of Things (IoT) Systems

  • Digital Teaching (Ernst Otto Fischer Teaching Prize 2013)
Some of my Digital Teaching

Format: Lab courses
Content: Computer Networks & Distributed Systems
Teaching Style: Blended Learning
Reach: >2000 students
Why?

2003 Universität Tübingen: Internetpraktikum 2003
Concrete Problems I address

• Does not **scale**.

• Inefficient:
  • Takes too much time for **students**.
  • Takes too much time for **correctors**.

• Not enough **guidance** to learn successfully.
How?

Methodology
Tools
Content

improve
listen
How?

Methodology

Tools

Content

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listen
Motivate, Motivate, Motivate

• Reward during learning

• Diversity in Teaching
  • Methods (discussion, multiple choice, free text, …)
  • Tools (eLearning, feedback, moderation, …)
  • Settings (group, individual, team, …)
  • Formats (lecture, self-preparation, practical exercise, …)
Overview

Lecture

Time

1-2h

~1-3h

1 day

~20min

Practical Teamwork

Individual Preparation

2x Individual Oral Exam

no additional reports

* Happening at the TUM
* Happening wherever you have Internet
* Happening within the eLearning environment
* Done with all participants alone, in your team
Demonstration lab

1. Demonstration PreLab content

So how does it work?

Hello The Tester (DemoUser), this lab is just for get

You find all elements you’ll find in a “real” lab here to

In a “real” prelab you will find many information that we

All labs have two parts:

• The prelab
• The lab

The prelab should give you the theoretical background
read the texts, the easier the lab will be for you.
There are multiple choice questions after most of the prelab
the most important aspects of the topics you just

You won’t have to wait until someone corrects your re
entry of the prelab) you find a button “check prelab”
what was wrong and what was right and sometimes you
You have multiple attempts to answer the questions.

To be able to perform the lab, each groupmember ha
Focussing & Constructive Alignment

Learning Goals

Lecture

PreLab

Lab

How should instructions be?

The exercises have a story!
Learn from each other...
The iLab Blended Learning Concept

The “forced” good student.

Lecture -> PreLab -> Both finished PreLab -> Lab -> Lab closed -> Correction -> All corrected

- Lecture: 90min
- PreLab: ~1-3h within 1 week
- Both finished PreLab: ~1 day within 1 week
- Lab: ~10h for <20 teams within 1 week

- lecture room
- where is Internet
- group
- individual
- lab room
- team of two
- where is Internet
- corrector team

How?

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Settings

Individual Preparation

Lecture

Practical Teamwork
Cosy working environment
eLearning prelab

not taken into account for grading
(directly learn from errors)

lecture recording  preparation texts  multiple-choice motivation  ranking + who did not finish?
eLearning lab

all instructions online

free text inputs inline

cross correction

course management

credits for grading

no additional reports

fast feedback
• Up-to-date content
• Diversity
• Clear flow of the exercises
• Getting the expected result is guaranteed
• Questions inline; no additional reports
• Learning support
• Mandatory PreLab
  • Instantly correcting multiple-choice questions
• Fast correction
• Redundancy
• Oral exams
• Teamwork - help each other!
• English
• Additional skills (esp. iLab2)
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Feedback

Self-Learning Support

Correction Comments
- Discussion with Others
- Ranking in the Group
- Multiple-Choice Results
- Discussion at the Lecture
- Credits
- Exam Feedback
- Exam Mark
- Oral Exam Impression
- Discussion at the Lecture
- Lab Credits

Feedback to the Teachers

Feedback is important to encourage the learners to continue learning. It is a main mean for motivation. Feedback is important for the teachers as well as it helps them to adapt to the needs of the current student group. The student feedback is continuously used to improve the exercises.
How?

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iLab exercises grow from continuous exchange. Exchange within the group of learners and between the students and the professors. The iLab encourages to exchange wherever possible. It is an important element of the success of the concept.
Evaluation

"I am able to address problems typical to the subject matter of this course."

59% completely agree
34.7% agree
5.3% neither agree nor disagree
0.8% disagree
0.2% completely disagree

\( n = 378 \)
\( \text{mean} = 1.42 \)
\( \text{median} = 1 \)
\( \sigma = 0.86 \)

"Overall, the practical training is well-organized in my opinion"

58.1% completely agree
29.5% agree
8.4% neither agree nor disagree
3.2% disagree
0.8% completely disagree

\( n = 370 \)
\( \text{mean} = 1.56 \)
\( \text{median} = 1 \)
\( \sigma = 1.1 \)

"[I like the] syllabus and the way the assignments are organized. The course content, paradigm, and the learning curve."

"Perfectly organized lab course with a good balance of team work, self-study and lecture."

"Good insight into various technologies. Comprehensive exploration of the topics at hand. Nice e-Learning system!"
Amount of Students + Amount of Instructors = Teaching Quality
Teaching Quality

Students

Amount of Instructors

Teaching Quality

+iLab Concept
Big thanks to my team members!

- Uwe Bilger was of invaluable help in designing the initial new set of exercises, and in iterating through the material and the concept in the first years (~2004-2006).

- Joachim Schiele and Andreas Korsten did a great job for evolving the hardware setup back in Tübingen.

- Stephan Günther did the entire hardware and software setup for Munich in 2008.

- Benjamin Hof and Lukas Schwaighofer did invaluable contributions to both labs including the iLabOS software (with Markus Teich), the lab room hardware setup, and the exercises! Their great expertise and dedication are unforgettable.

- Also thank you to all advisors (chronological order):
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- And all student tutors!
Methodology

Tools

Questions?

Content
Resources


• Labsystem eLearning Environment http://github.com/m-o-p/labsystem

• iLab - Build your own Internet https://ilab.net.in.tum.de/

• iLab2 - You set the Focus https://ilab2.net.in.tum.de/

• iLabX - The virtualized Networking Laboratory https://s2labs.org/?site=mooc4masters