



# New trends in EE: PBL and international mega projects

Anette Kolmos

Professor at the UNESCO Chair

<http://www.ucpbl.net>



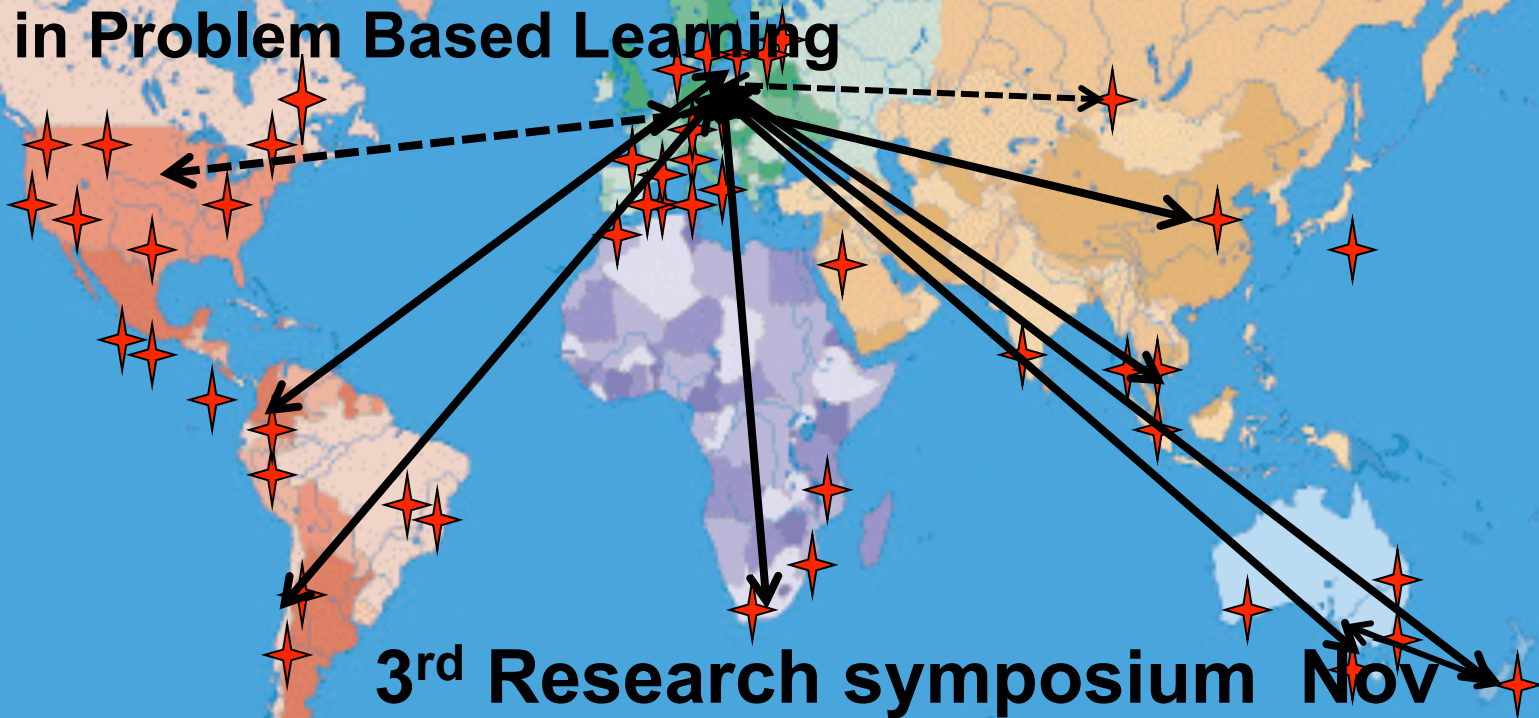
UNESCO CHAIR  
PROBLEM BASED LEARNING  
AALBORG UNIVERSITY • DENMARK



**Collaboration agreements: staff training  
and PhD**

**Master in Problem Based Learning**

**3<sup>rd</sup> Research symposium Nov  
28-29, 2011  
Coventry University, UK**





# Malaysia PhD programme

What can you do???

- What can be done at your institution?
- What are the barriers?
- What are the potentials?





# Consultancy

Tsinghua University – memory of understanding signed

WORKSHOP SESSION @ TSINGHUA UNIVERSITY  
WORKSHOP SESSION @ TS

清华大学百年校庆  
TSINGHUA UNIVERSITY  
CENTENARY CELEBRATION

IIDEA WORKSHOP SESSION  
IIDEA WORKS  
IIDEA WORKSHOP SESSION @ TSINGHUA UNIVER

学习环境: May 30th

跨越工程教学与工程实践的鸿沟  
Learning Environments:  
Bridging the Gap between the Way We Teach and the Practice of Engineering

基于问题和项目的学习 May 31th  
Problem and Project Based Learning

清华大学 北京  
Tsinghua University, Beijing, China  
May 30th-31st, 2011

主办: 清华大学工程教育研究中心  
Hosted by: CEE, Tsinghua University

主讲: 国际工程教育发展研究院专家  
Presented by: IIDEA workshop leaders

赞助: 迈斯沃克公司  
Sponsored by: Mathworks, Inc.

支持: 中国高等教育学会工程教育专业委员会  
Supported by: Chinese Society for Engineering Education

IIDEA WORKSHOP SESSION @ TSINGHUA UNIV  
IIDEA WORKSHOP SESSION @ TSINGHUA UNIV  
IIDEA WORKSHOP SESSION @ TSINGHUA UNIV



# Thailand – establishment of sub center



# Singhad Institute – India

## PBL sub center





# Victoria University/Australia



30  
participants  
from Victoria  
university  
MPBL

# Reform universities - new systems: PBL



## Medicine

- Problems form the focus and stimulus for learning
- Problems are the vehicle for development of problem solving skills
- New information is acquired through self directed learning
- Student-centred
- Small student groups
- Teachers are facilitators/guides

## Danish models

- Problem orientation
- Interdisciplinarity
- Exemplary learning
- Participant directed
- Teams or group work



# PBL- learning principles

## **Learning**

Problem based  
Contextual learning  
Project based / organised  
Activity/experience based learning

## **Social**

Participant directed  
Team based learning

## **Content**

Theory-practice relation  
Interdisciplinary learning  
Exemplary learning  
Meta-learning/ Double loop learning



# CASE A - model

Semester 1-4	Course 5ECTS	Course 5ECTS	Course 5ECTS	Course 5ECTS	Project 10 ECTS
Semester 5	Practicum				
Semester 6	Course 5ECTS	Course 5ECTS	Course 5ECTS	Course 5ECTS	Course and pre project 10 ECTS
Semester 7	Course 5ECTS	Course 5ECTS	Project 20 ECTS		

Total 210 ECTS:

30 ECTS for practicum,

60 ECTS for projects

120 for traditional courses



# CASE B - model

Semester 1-4	Courses	Courses	Project 10 ECTS pr. semester
Semester 5	Course	Course	Project 18 ECTS
Semester 6	practicum		
Semester 7	Project normally with a company 30 ECTS		

Total 210 ECTS:

30 ECTS for practicum,

88 ECTS for projects

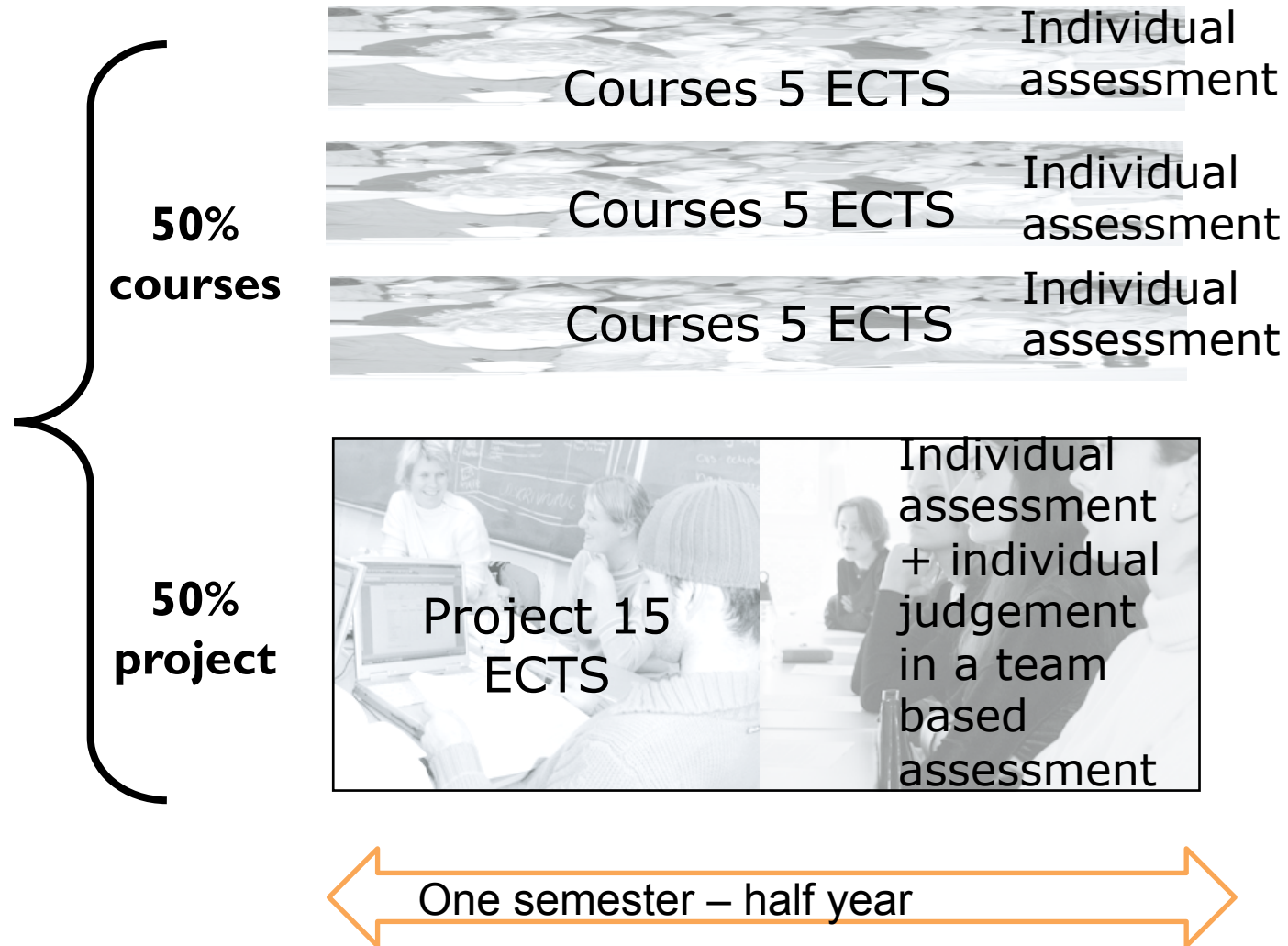
92 for traditional courses

# Case C – Aalborg Model

Semester	Course 5 ECTS	Course 5 ECTS	Course 5 ECTS	Project 15 ECTS
1-2				
3-7				
8-10				



# The new Aalborg Model



1 ECTS (European Credit Transfer System)  
= 30 working hours



**One project  
per semester**





# Diversity of physical facilitation

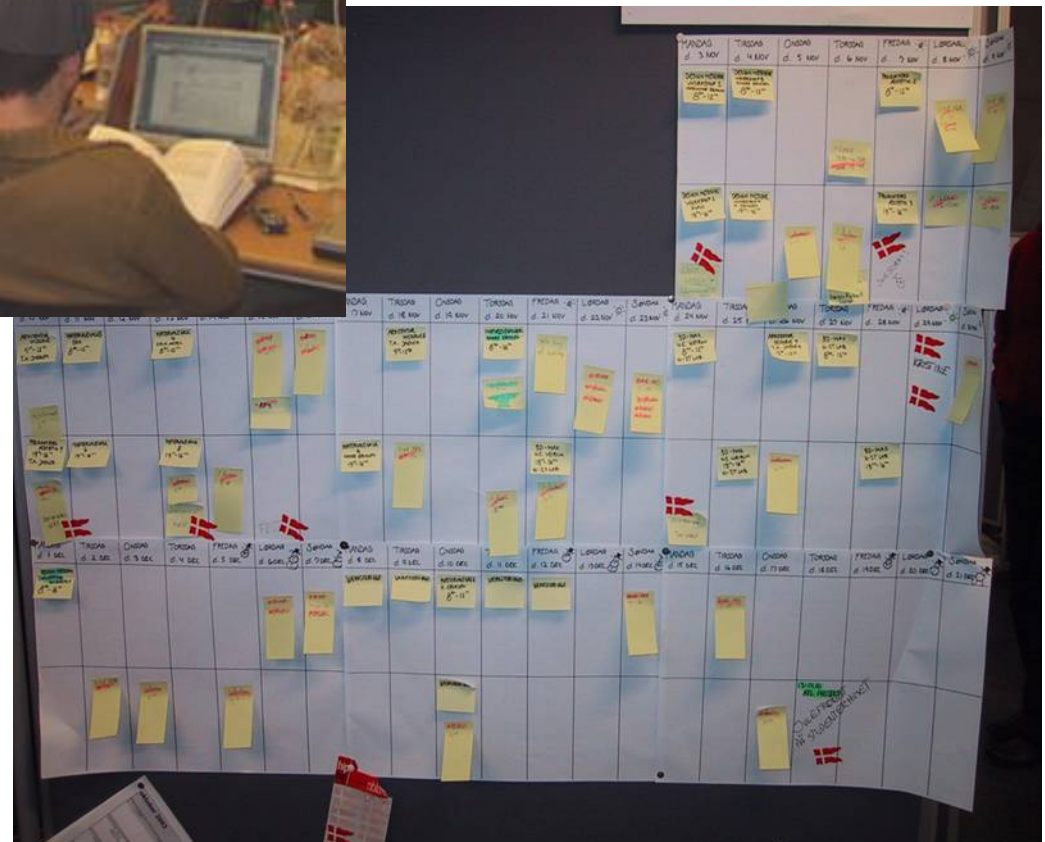
## More than 1200 rooms for teams





# Self organised groups

## Project management





# Many different types of projects




# Facilitation and group dynamics




# School of Engineering and Science

## <http://www.en.ses.aau.dk>



Persons Websites


Search




School of Engineering and Science

Student Testimonials, Civil Engineering


**Errki Seinre**  
**Former student of Indoor Environmental Engineering**  
"My first aim was actually to go to Holland, but they never answered my request for information. Hence, I did not bother, but tried AAU instead - they answered quickly..."  
[Read more...](#)




**Jacob Hausgaard Lyng**  
**Former student of Structural and Civil Engineering**  
"When I began studying Civil Engineering, it was because of my fascination of large buildings and infrastructure projects..."  
[Read more...](#)




**Jannie Jessen Nielsen**  
**Former student of Structural and Civil Engineering**  
"The reason why I chose to become an engineer in the first place was my fascination of large structures and the fact that I liked and was good at both math and physics..."  
[Read more...](#)




**Sara Thomas**  
**Former student of Indoor Environmental Engineering**  
"I am a Socrates-Erasmus exchange student, and I chose to study at AAU for several reasons..."  
[Read more...](#)



**Timothy Thrippleton**  
**Student of Physical Geography**  
"This year here at Aalborg University was full of new experiences for me..."  
[Read more...](#)



**Txema Urrutia Aldama**  
**Former student of Civil Engineering**  
"After a year of working after my Bachelor, I decided to go abroad to study..."  
[Read more...](#)



HOME

ACADEMIC PROGRAMMES

ADMISSION

STUDY WEB

COLLABORATION

STUDY BOARDS

ABOUT US

CONTACT

**STUDENT TESTIMONIALS**

BIOTECHNOLOGY, CHEMISTRY AND ENVIRONMENTAL ENGINEERING

CIVIL ENGINEERING

ENERGY ENGINEERING

INDUSTRY AND GLOBAL BUSINESS ENGINEERING

MATHEMATICS, PHYSICS AND NANOTECHNOLOGY



## Civil Engineering: Storey houses of wood - the pros and cons



Mona Danms, AAU

# **Domicil Monjasa**

## **- Bygningens konstruktion og energiforbrug**

**Kasper Fonnesbæk**

**Julie Trude Jensen**

**Kristian Kvottrup**

**Palle Sand Laursen**

**Karina Bak Pedersen**

**Andreas Elkjær Riis**



Dimension of the roof  
construction made by  
tree and concrete  
+  
Energy consumption

**B4 projekt**  
**4. semester AAU**

# Treatment plants of Wastwater,

## Bachelor project, 6 students in a group

- In the present project, the focus is on Aalborg WWTP East. The project consists of an analysis of the WWTP including a mass balance of selected organic micropollutants. First, the necessary and future dimensions on the plant were calculated and it was analysed if it was fit for the future, where the load is expected to increase. The conclusion of this was that the current load is lower than what the plant is originally dimensioned for. In the future the plant is capable of handling the load that increases, because the calculated future tank volumes are lower than the actual volumes.
- The mass balance of selected organic micropollutant was investigated. The conclusion on this was that the breakthrough ranges roughly from 15-30%. This is lower than usually seen at other WWTPs which indicate a good removal. The WWTPs have different hydraulic- and sludge retention times, therefore the results are not easily comparable. Through the measurements in the process tank variations could be seen, but it was not possible to prove, if the variations was due to the alternating processes. Breakdown products were found in the sludge.



# Contents

1 Introduction	3 Loads and Tank Volumes
1.1 The Structure of Wastewater Treatment in Aalborg Municipality	3.1 Current Loads
1.2 Aalborg Wastewater Treatment Plant East	3.2 Current Tank Volumes and Function
1.3 Formulation of the Problem	3.3 Current Necessary Tank Volumes
	3.4 Future Loads and Necessary Tank Dimensions
	3.5 Discussion of Dimensions
2 Aalborg Wastewater Treatment Plant East	
2.1 General Structure	4 Organic Micropollutants
2.2 Grating and Grit Chamber	4.1 Compounds of Interest
2.3 Anaerobic Tank	4.2 Materials and Methods
2.4 Process Tank	4.3 Results and Discussion
2.5 Clarifier	4.4 Effects of the Different Processes
2.6 Hydrolysis Tank	
2.7 Sludge Handling	5 Conclusion
2.8 Removal of Nutrients	Bibliography
	Appendices

# Master level 9<sup>th</sup> semester, 4 students



## Wind Turbine Operating in Extreme Cold Climate

*Students' Report*



STRUCTURAL AND CIVIL ENGINEERING

3RD. SEMESTER

AALBORG UNIVERSITY

In this report wind turbines in cold climate have been analysed. The attention has been put on the difference in the design of the blade cross-section considering the climatic characteristics of two different sites: Aalborg (Denmark) for normal conditions and Aapua (Sweden) as representatives for an extreme cold climate site.

The two materials taken into account have been compared by analysing the static tension, static compression and constant amplitude tests.

The study has been focused on fatigue analysis and it has been done by means of the characteristic SN curves. This has been possible by considering different temperatures and different wind distributions, performed by the Weibull distribution. The analysis of the wind loads has been carried out by using the Rainflow counting considering the out- of-plane bending moment. The difference in section modulus has therefore been evaluated by using the Miner's rule.



# Next phase in PBL: mega projects

## Chunfang Zhou, 2010 and 11

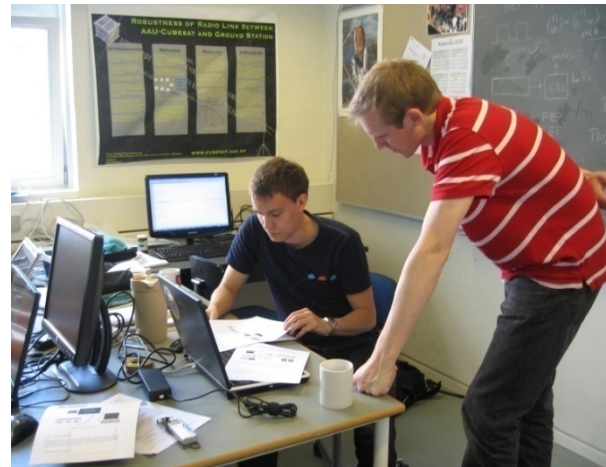
- ***Across semesters - from 4th semester to 10th semester***
- ***Motivation to participate***
  - The satellite project sounds interesting
  - To learn more knowledge and skills
  - To prepare themselves for the workplace in the future



## Group Learning in Project Work

- ***Group meeting once a week , discussion always, debate sometimes***
  - *Peer Learning*
  - *Facilitated by reflection from practice*

*“We haven’t got any new ideas sometimes actually, I think. However, we can test ideas from different books and put them together. It’s like discussing what the opportunities are to solve the problem.” - A Student*





- Research projects at the UNESCO Chair
  - External: research council projects
  - Internal projects evaluation of the new PBL model – ongoing
  - Group assessment and PBL
- 15 PhD studerende
  - Creativity and mega projects (satellit)
  - Organisational change to PBL
  - PBL and the subject identity
  - Design of PBL curricula in Thailand, India og Malaysia
  - Intercultural learning in teams
  - PBL and sustainability – strategies for implementation



# National Academy Skills and competences: engineering in 2020:

**Technological** (e.g., bio-tech, digital systems, computer systems/tools, sustainable technology, interdisciplinarity)

**Societal, Global, and Professional** (e.g., social, political & economic, diversity, multi-disciplinarity, global markets & contexts, interaction of engineering and public policy)

## Attributes of the Engineer of 2020:

- Strong analytical skills
- Practical ingenuity
- Creativity
- Communication competencies (oral, written, and cultural)
- Business, management, and leadership skills
- High ethical standards and professionalism
- Agility, resilience, flexibility



## Engineering graduates for industry

February 2010



- Industrial simulation such as constructionarium and pilot plants
- Sponsored programmes
- Industrial liaison boards
- Project-based and other forms of active learning
- Industrial group projects
- Lectures / seminars from engineers in industry
- Case studies from industry Influence of part-time and mature students on full-time students

# The Global Engineer

## Incorporating global skills within UK higher education of engineers

Douglas Bourn and Ian  
Neal

EAP and Development  
Research Centre

*March 2008*

- The ability to take a broader perspective - application of curriculum across countries
- An appreciation of what we do in developing countries impact upon ourselves.
- Understanding our culture doesn't have all the answers and there is more than one perspective and approach.
- Understanding the local context of development
- Coping with uncertainty

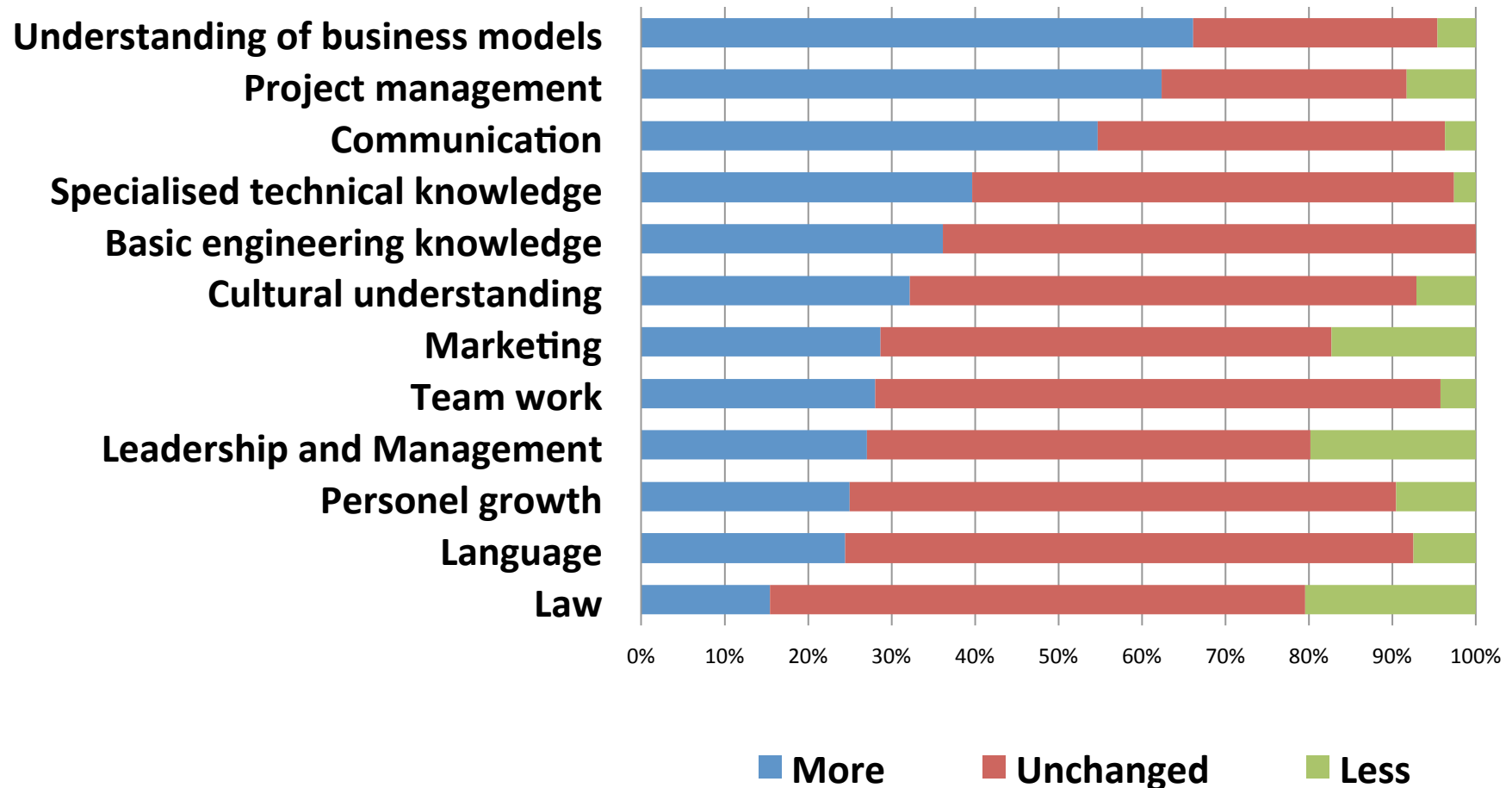


# Educating engineers

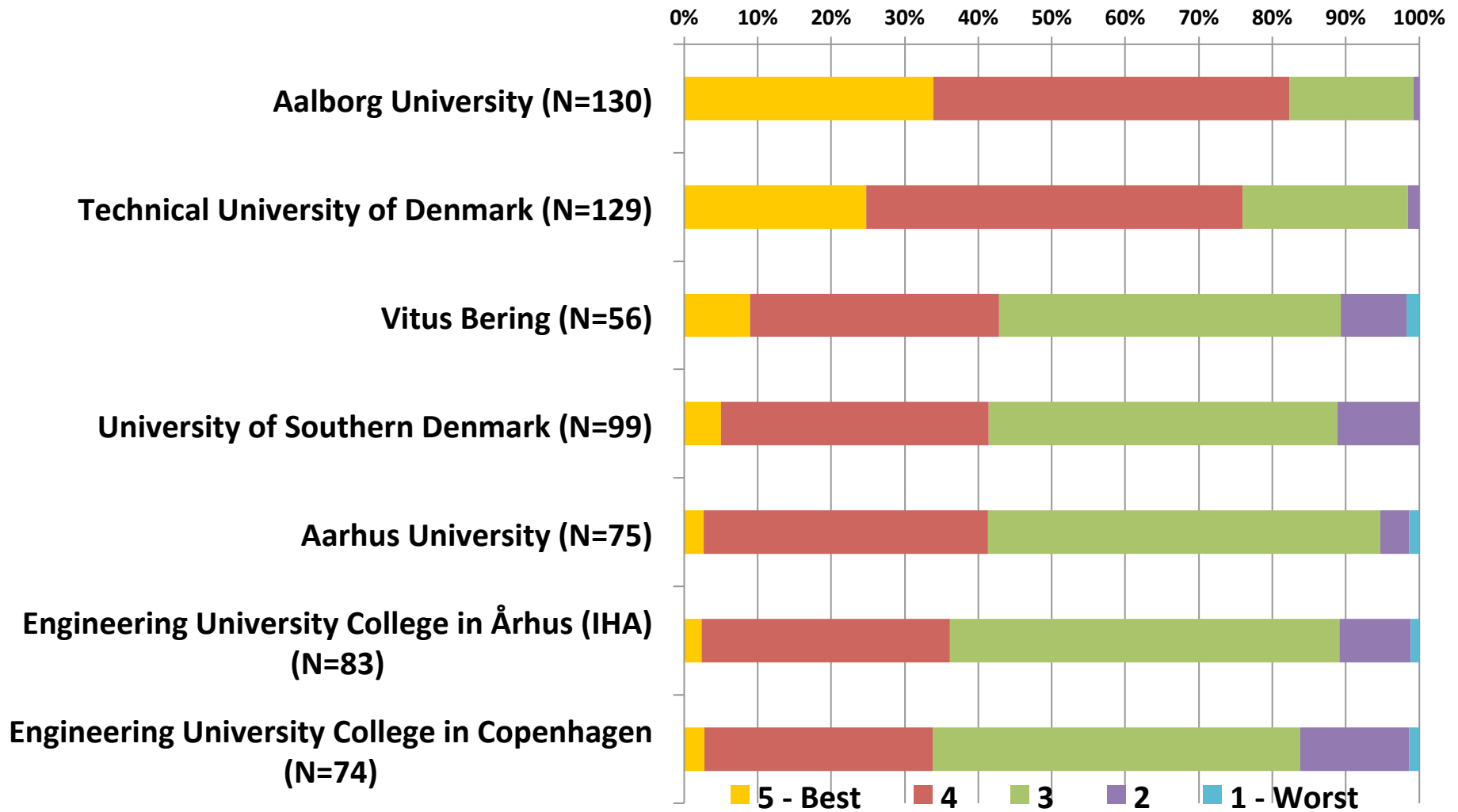
- Add on strategy for the curriculum – one more block
- Criticism of linear block system
- Arguing for design capabilities and a more problem based and project based system
- Complexity and technological integration



**Is there a need for change of the existing engineering  
educations to match companies' need and challenges?  
(N=183) (Ingeniøren, 2008)**

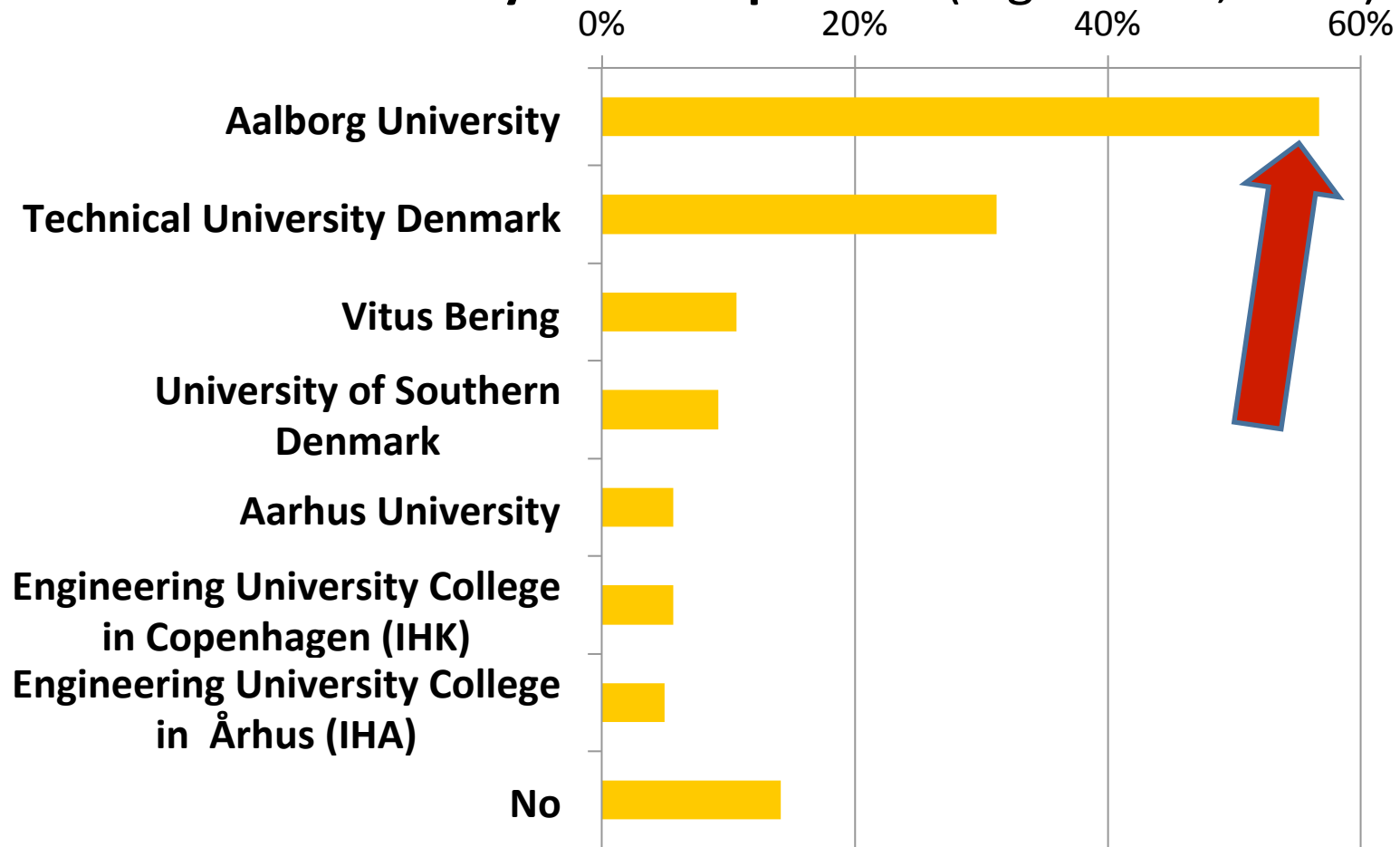


# Overall assessment of Danish Engineering Institutions by companies (Ingeniøren, 2008)

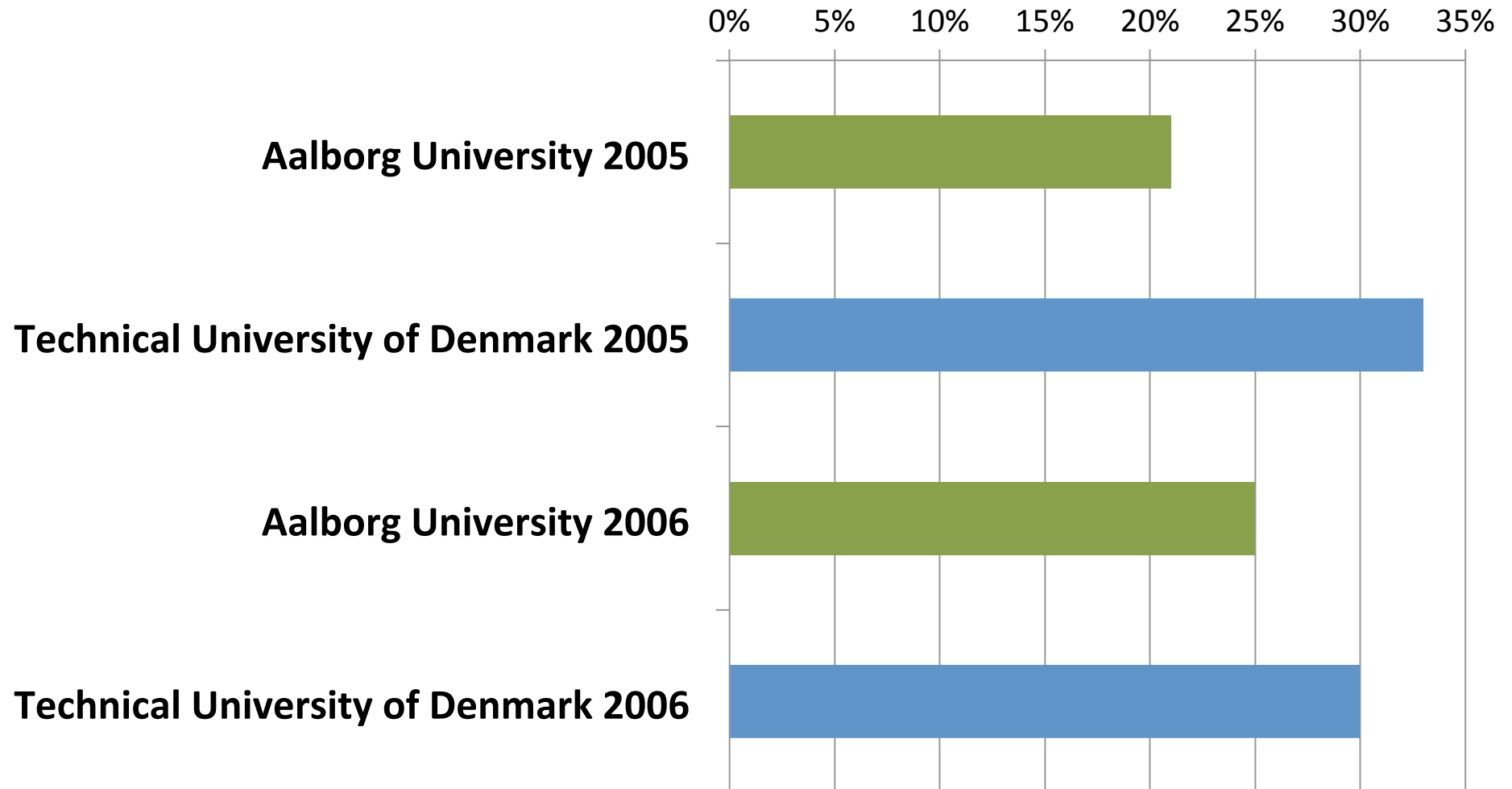




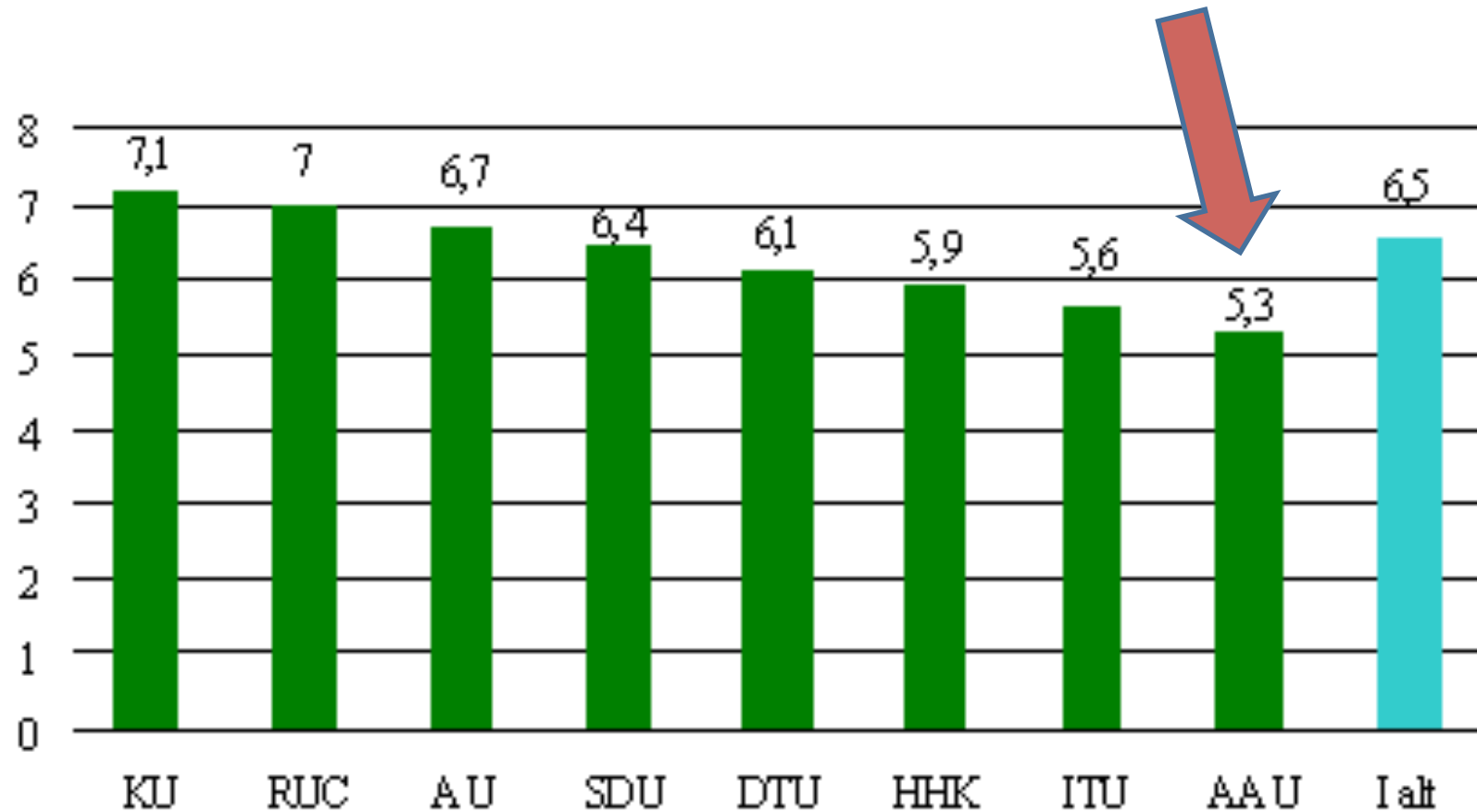
**Are there one or more institutions which you find particular good at developing engineering education according to the needs of society and companies? (Ingeniøren, 2008)**



# Official statistics: Drop out rate



# Duration rates for Danish universities, 2007, Official statistics





# Active learning

## Traditional curriculum

lectures

Students individual  
work

Assessment

## Active learning curriculum

Lectures

Team work

Assessment

<b>Vision +</b>	<b>Consensus +</b>	<b>Skills +</b>	<b>Incentives +</b>	<b>Resources +</b>	<b>Action Plan +</b>	<b>= Change</b>
	Consensus +	Skills +	Incentives +	Resources +	Action Plan +	<b>= Confusion</b>
Vision +		Skills +	Incentives +	Resources +	Action Plan +	<b>= Sabotage</b>
Vision +	Consensus +		Incentives +	Resources +	Action Plan +	<b>= Anxiety</b>
Vision +	Consensus +	Skills +		Resources +	Action Plan +	<b>= Resistance</b>
Vision +	Consensus +	Skills +	Incentives +		Action Plan +	<b>= Frustration</b>
Vision +	Consensus +	Skills +	Incentives +	Resources +		<b>= Treadmill</b>

# Master in PBL in EE - Curricula

Program Module	Modules	ECTS	Assessment	
<b>1. semester</b>	Course: Teaching and Learning in Engineering , Science and Health	5	P/NP	Internal
	Project: Teaching portfolio	5	7 step scale	Internal
<b>2. semester</b>	Course: PBL models and change strategies	5	P/NP	Internal
	Course: Process competences and facilitation	5	P/NP	Internal
	Project: PBL experiments	10	7 step scale	External
<b>3. semester</b>	Course: Theory and methods	5	7 step scale	Internal
	Optional course: PBL and sustainability PBL and intercultural learning PBL and management	5	P/NP	Internal
	Project: Master project	20	7 step scale	External
<b>In total</b>		60		



Thank you very much

