Welcome at KU Leuven Technology Campus Gent
History

1425
Foundation by Papal Bull

1797
Abolition by the French authorities

1816
Refoundation as a state university under Dutch rule

1834
Restoration as a Catholic university

1911
First lectures in Dutch

1965
Foundation of Kulak

1970
Division of the university into KU Leuven and U.C.Louvain

2008
6 university colleges of the KU Leuven Association sign an agreement to join their educational programmes in the Associated Faculty of Engineering Technology and Bioscience Engineering

2013
KU Leuven expands to include academic degree programmes hosted at university colleges within KU Leuven Association

Technology Campus Ghent
The new Faculty of Engineering Technology is the 14th faculty of KU Leuven
Pope Adrianus VI (1459-1523)
Desiderius Erasmus (1466-1536)
Andreas Vesalius (1514-1564)
Gerardus Mercator (1512-1594)
Organisation KU Leuven

15 faculties organised into 3 ‘groups’

<table>
<thead>
<tr>
<th>Board of Trustees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board of Governors</td>
</tr>
<tr>
<td>Academic Council</td>
</tr>
<tr>
<td>Executive Board</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Humanities &amp; Social Sciences Group</th>
<th>Biomedical Sciences Group</th>
<th>Science, Engineering &amp; Technology Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>30,195 students</td>
<td>11,859 students</td>
<td>18,087 students</td>
</tr>
<tr>
<td>5,110 international</td>
<td>1,516 international</td>
<td>3,689 international</td>
</tr>
</tbody>
</table>
Faculty of Engineering Technology
FIIW

Group Science & Technology

Faculty of Science
Faculty Engineering Science
Faculty Bio-Engineering Science
Faculty of Engineering Technology
Faculty Architecture

Campus in GENT
Mission Faculty of Engineering Technology

Unique combination of research based curricula and practice-based courses

Researchers with practical experience in the implementation of knowledge and technology in different companies or spin-offs

Multicampus faculty with strong local ties Community Service Engineering
Faculty of Engineering Technology
Faculty of Engineering Technology

TOTAL FIIW 6450 students

KU LEUVEN

345 students
OOSTENDE

KU LEUVEN

867 students
GENT

KU LEUVEN

689 students
SINT-KATELIJNE-WAVER

KU LEUVEN

1709 students
AALST

KU LEUVEN

2060 students
LEUVEN

KU LEUVEN

872 students
DIEPENBEEK

KU LEUVEN

TOTAL FIIW 6450 students

Technology Campus Ghent
Students Faculty of Engineering Technology

![Graph showing student numbers from 2006-2014]
KU Leuven Technology Campus Gent
Engineering Technology in Gent at a glance

1700 students

6 Master degrees

14 research groups

103 staff members
94 contractual coworkers (PhD researchers, postdoc, projects)
€ 4,329,000 external research funding (industry, IWT)
Educational programs
Engineering Technology

Ba: 180 EC; Ma: 60 EC

Bachelor Engineering Technology: (Bio)Chemistry
Bachelor Engineering Technology: Electromechanics
Bachelor Engineering Technology: Electronics – ICT
Bachelor Engineering Technology: Construction

Master Engineering Technology: Construction
Master Engineering Technology: Chemistry
Master Engineering Technology: Biochemistry
Master Engineering Technology: Electronics – ICT
Master Engineering Technology: Electromechanics
Master Engineering Technology: Energy

European Master of Science in Food Science, Technology and Nutrition (Erasmus Mundus) (120 EC)
Profiles in Engineering and Technology
Bachelor’s programmes

*(E) Programmes in English*

<table>
<thead>
<tr>
<th>Bachelor of Science in Engineering Technology</th>
<th>CAMPUS GROUP T LEUVEN</th>
<th>TECHNOLOGY CAMPUS DE NAYER</th>
<th>TECHNOLOGY CAMPUS GEEL</th>
<th>TECHNOLOGY CAMPUS GENT &amp; AALST</th>
<th>TECHNOLOGY CAMPUS OSTEND</th>
<th>TECHNOLOGY CAMPUS DIPENBEEK</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Civil Engineering</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>- Chemical Engineering</td>
<td>■ (E)</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>- Electromechanical Engineering</td>
<td>■ (E)</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>- Electronics and ICT Engineering</td>
<td>■ (E)</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>- Polymer Processing Technology</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>- Nuclear Engineering</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>- Packaging Engineering</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>Bachelor of Science in Bioengineering Technology</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
</tbody>
</table>
Curriculum development

7 majors

- Civil engineering
- Chemical Engineering
- Electromachanical Engineering
- Electronics and ICT Engineering
- Polymer processing Engineering
- Nuclear Engineering
- Packaging Engineering

5 options

BIO-ENG. TECH.

ENGINEERING TECHNOLOGY

phase 1

1

2

phase 2

3

4

phase 3

1

2

3

4

5
# Master’s programmes

**(E) Programmes in English**

<table>
<thead>
<tr>
<th>Master of Science in Engineering Technology</th>
<th>CAMPUS GROUP T LEUVEN</th>
<th>TECHNOLOGY CAMPUS DE NAYER</th>
<th>TECHNOLOGY CAMPUS GEEL</th>
<th>TECHNOLOGY CAMPUS GHENT &amp; AALST</th>
<th>TECHNOLOGY CAMPUS OSTEND</th>
<th>TECHNOLOGY CAMPUS DIEPENBEEK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemical Engineering</td>
<td>■ (E)</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>Electromechanical Engineering</td>
<td>■ (E)</td>
<td>■ ■ ■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>■ (E)</td>
<td>■ ■ ■</td>
<td>■■ ■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>Electromechanics Engineering</td>
<td>■ (E)</td>
<td>■ ■ ■</td>
<td>■■ ■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>Electronics and ICT Engineering</td>
<td>■ (E)</td>
<td>■ ■ ■</td>
<td>■■ ■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>Energy Engineering</td>
<td>■■■</td>
<td>■ ■■ ■</td>
<td>■■■ ■</td>
<td>■</td>
<td>■■■■</td>
<td>■</td>
</tr>
<tr>
<td>Polymer Processing Technology</td>
<td>■</td>
<td>■ ■■</td>
<td>■■■■</td>
<td>■</td>
<td>■■■■■</td>
<td>■</td>
</tr>
<tr>
<td>Nuclear Engineering</td>
<td>■</td>
<td>■ ■■</td>
<td>■■■■</td>
<td>■</td>
<td>■■■■■</td>
<td>■</td>
</tr>
<tr>
<td>Packaging Engineering</td>
<td>■</td>
<td>■ ■■</td>
<td>■■■■</td>
<td>■</td>
<td>■■■■■</td>
<td>■</td>
</tr>
</tbody>
</table>

**European Master of Science in Food Science, Technology and Nutrition**

- ■ (E)

**Master of Science in Bioengineering Technology**

- Agro- and Horticultural Engineering ■
- Food Industry Engineering ■
## Postacademic programmes

*(E) Programmes in English*

<table>
<thead>
<tr>
<th>Campus Group/T-campus</th>
<th>Technology Campus De Nayer</th>
<th>Technology Campus Geel</th>
<th>Technology Campus Ghent &amp; Aalst</th>
<th>Technology Campus Ostend</th>
<th>Technology Campus Diepenbeek</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master of Science in Engineering Technology: Industrial Polymer Processing Engineering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Master of Science in Welding Engineering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Postgraduate programmes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovation and Entrepreneurship in Engineering</td>
<td>(E)</td>
<td>(E)</td>
<td>(E)</td>
<td>(E)</td>
<td>(E)</td>
</tr>
<tr>
<td>Community Service Engineering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(E)</td>
</tr>
<tr>
<td>Enterprising</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(E)</td>
</tr>
<tr>
<td>Logistics Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(E)</td>
</tr>
</tbody>
</table>
Gender

- Boys: 87%
- Girls: 13%
University College Odisee

Professional Bachelors (3 year, 180 EC)
• Chemistry
• Elektronics – ICT
• Energy technology
• Design and production technology
• Biomedical lab technology
• Food and dietetics
• Facility Management

Many cooperations
# Science, Engineering & Technology Group

<table>
<thead>
<tr>
<th>Faculties</th>
<th>Research departments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>» Architecture, Urbanism and Planning</td>
</tr>
<tr>
<td>Engineering</td>
<td>» Biology</td>
</tr>
<tr>
<td>Bioscience Engineering</td>
<td>» Biosystems</td>
</tr>
<tr>
<td>Engineering Technology</td>
<td>» Chemical Engineering</td>
</tr>
<tr>
<td>Architecture</td>
<td>» Chemistry</td>
</tr>
<tr>
<td></td>
<td>» Civil Engineering</td>
</tr>
<tr>
<td></td>
<td>» Computer Science</td>
</tr>
<tr>
<td></td>
<td>» Earth and Environmental Sciences</td>
</tr>
<tr>
<td></td>
<td>» Electrical Engineering (ESAT)</td>
</tr>
<tr>
<td></td>
<td>» Mathematics</td>
</tr>
<tr>
<td></td>
<td>» Mechanical Engineering</td>
</tr>
<tr>
<td></td>
<td>» Metallurgy and Materials Engineering</td>
</tr>
<tr>
<td>Arenberg Doctoral School</td>
<td>» Microbial and Molecular Systems</td>
</tr>
<tr>
<td></td>
<td>» Physics and Astronomy</td>
</tr>
</tbody>
</table>
# Research Activities

**7 research units, 14 Research Groups**

## Civil Engineering
- Sustainable Building Research
- Structural Mechanics and Materials
- Geomatics and Surveying

## Biochemistry
- Enzyme, Fermentation and Brewing Technology
- Research group for Technology and Quality of Animal Products
- Odour and Flavour Research

## Chemistry
- Chemical Process Technology

## Electrical Engineering
- Light&Lighting
- Energy and Automation (E&A)
- Wireless and Mobile Communications (DraMCo)

## Computer Science
- Combinatorial Optimisation and Decision support (CODeS)
- Mobility and Security (MSEC)

## Materials Engineering
- Mechanics of Materials, Products and Processes (MeM2P)
- Control and Mechanics of Power Transmissions (MeSA)
1.1 Sustainable Building Research Group

- very low energy buildings (building envelope, ventilation- and cooling techniques)
- sustainable materials and structures
- quality control

Contact:
Ralf Klein (ralf.klein@kuleuven.be)
1.2 Structural Mechanics and Building Materials

- The development of a prediction model for the human-induced vibrations of civil engineering structures based on measurements and computer simulations (bridges, stages).

- Acceptability of vibration levels

- Remedies to reduce vibration levels.

Contact:
Peter Van den Broeck (peter.vandenbroeck@kuleuven.be)
http://www.kuleuven.be/samenwerking/bwm
1.3 Geomatics-Surveying Research group

- Large scale mapping: combination of the CAD-environment with the Geographic Information System GIS

- Establishment of a large scale GIS-database of Flanders with precise topographical reference data (finished by 2014).

- 3D-modeling using photogrammetry and laser scanning

Contact:
Guido Kips (guido.kips@kuleuven.be)
2.1 Laboratory for Enzyme, Fermentation and Brewing Technology

- Enzyme technology
- Malting technology
- Brewing technology: flavour profiling, beer stability, high-tech hopping
- Fermentation technology: functionality of higher Fungi, production of bio-ethanol

Contact:
Luc De Cooman  (Luc.DeCooman@biw.kuleuven.be)
2.2 Laboratory for Food Chemistry and Meat Technology

• Processing of meat products: product development and process control

• Chemical and bacteriological safety of meat products

• Functionality of food ingredients and additives

• Animal welfare

Contact:
Hubert Paelinkck (Hubert.paelinck@kuleuven.be)
2.3 Molecular Odour Chemistry

• Understanding the chemical background of the flavour of food products the odour of industrial materials.

• Project concerning odour of non-food materials deal with perfumes and cosmetics, polymers (cars), and printed materials.

• Panel room, GC equipped with a sniffing port and specific detector for sulphur compounds

Contact: Jim Van Durme (Jim.vandurme@kuleuven.be)
2.4 Laboratory for Chemical Processing Technology

- Electrolytical deposition of metals and non-ferro materials
- Liquid membranes (unique pilot plant, 38 m2), electrodialysis and membrane distillation.
- Non-pressure driven membrane technologies.

**Contact:** Luc Pinoy ([luc.pinoy@kuleuven.be](mailto:luc.pinoy@kuleuven.be))
3.1 Light & Lighting

• Lighting and energy efficiency

• Optical design of secondary optics using ray-tracing software

• Appearance (colour and gloss)

• New light sources: LED, remote phosphor, OLED, integration of fluorescent quantum dots

• Photovoltaics cells

Contact: Peter Hanselaer
(peter.hanselaer@kuleuven.be)
www.lichttechnologie.be
3.2 Energy and Automation (E&A)

- Industrial data communication
- Analysis and design of control systems, electrical drive technology, **modeling** of dynamical systems
- Intelligent use and management of electrical energy in **hybrid and stand-alone energy plants**: cogeneration, photovoltaic solar cells and supercapacitors
- Reliability analysis of electrical installations.

Contact: Jan Cappelle (jan.cappelle@kuleuven.be)
http://www.kuleuven.be/samenwerking/eea
3.3 Wireless and Mobile Communications

- **Standards** and systems for wireless and mobile communications: RF and VLC
- Indoor localization and context awareness
- Internet of Things, Cyberphysical systems
- Wireless power
- The creation of **new applications** in the world of wireless communications.

**Contact**: Lieven De Strycker ([Lieven.destrycker@kuleuven.be](mailto:Lieven.destrycker@kuleuven.be))
4.1 Combinatorial Optimisation and Decision support (CODeS)

To solve complex problems in timetabling, rostering, scheduling, routing, cutting & packing for applications such as health care, production, logistics, tourism.

Development of mathematical (optimal) algorithms, heuristics, generic adaptive approaches, meta- and hyperheuristics

Contact: Greet Vanden Berghe (Greet.vandenberghe@cs.kuleuven.be)
http://www.kuleuven.be/samenwerking/codes
4.2 Mobility and Security (MSec)

- Modelling secure and mobile environment with focus on eID
- PET (Privacy Enhancing Technology)
- Sensor networks and RFID technology for the transport sector.
- Reconfigurable embedded systems.

Contact: Vincent Naessens (Vincent.naessens@kuleuven.be)  
http://www.kuleuven.be/samenwerking/msec
5.1 Mechanics of Materials, Products and Processes (MeM2P)

- Determination of elasto-plastic material parameters by combining Digital Image Correlation (DIC) experimental data and numerical simulations in inverse methods
- Extension to DIC measurements on concrete, composites, cardboard and plastics
- Development of in-house DIC code MatchID 2D and MatchID 3D
- PhD course on DIC + user forum

Contact: Dimitri Debruyne (dimitri.debruyne@kuleuven.be)
http://www.kuleuven.be/samenwerking/mem2p
5.2 Control and Mechanics of Power Transmissions (MeSA)

- Hydraulic tractions
- Industrial control of mechanical and electrical tractions.
- Development of advanced motion control algorithms for industrial servo controllers.

Contact: Marc Juwet (Marc.Juwet@kuleuven.be)
**Onderzoekers wekken Belgisch bier uit 1842 weer tot leven**

02 Oktober 2014

Onderzoekers van de KU Leuven, campus Gent, zijn erin geslaagd om bier uit 1842 te reconstrueren. Daarvoor baseerden ze zich op flessen bier die in 2010 werden gevonden in een 19de-eeuws schepswrak voor de kust van Finland. Een Finse brouwerij zal het bier nu gaan verkopen.

In 2010 werden 145 flessen champagne en vijf flessen bier gevonden in een schepswrak voor de kust van de Finse Ålandeilanden.

© Marcus Lindholm - Visit Åland
Some research numbers

- PhD’s in progress at our Campus

<table>
<thead>
<tr>
<th>Org. eenheid autoris</th>
<th>Totaal</th>
</tr>
</thead>
<tbody>
<tr>
<td>KU Leuven Gent-Aalst</td>
<td>46</td>
</tr>
<tr>
<td>Groep W&amp;T Gent-Aalst</td>
<td>46</td>
</tr>
<tr>
<td>TC Bouw Gent-Aalst</td>
<td>4</td>
</tr>
<tr>
<td>TC Chemische Procestechn. Gent-Aalst</td>
<td>3</td>
</tr>
<tr>
<td>TC Computerwetenschappen Gent-Aalst</td>
<td>6</td>
</tr>
<tr>
<td>TC Elektrotechniek (ESAT) Gent-Aalst</td>
<td>17</td>
</tr>
<tr>
<td>TC Materialentechnologie Gent-Aalst</td>
<td>6</td>
</tr>
<tr>
<td>TC Bioengineering Technologie Gent-Aalst</td>
<td>10</td>
</tr>
</tbody>
</table>
Some research numbers

• Journal publications

<table>
<thead>
<tr>
<th>Publicatiejaar</th>
<th>Aantal IT-publicaties</th>
<th>Top 5% IT-publicaties</th>
<th>Top 10% IT-publicaties</th>
<th>Top 15% IT-publicaties</th>
<th>Top 20% IT-publicaties</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>40</td>
<td>4</td>
<td>9</td>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>2011</td>
<td>44</td>
<td>7</td>
<td>10</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>2012</td>
<td>54</td>
<td>10</td>
<td>14</td>
<td>29</td>
<td>31</td>
</tr>
<tr>
<td>2013</td>
<td>56</td>
<td>9</td>
<td>13</td>
<td>18</td>
<td>26</td>
</tr>
<tr>
<td>2014</td>
<td>66</td>
<td>14</td>
<td>19</td>
<td>26</td>
<td>33</td>
</tr>
<tr>
<td>Totaal:</td>
<td>260</td>
<td>44</td>
<td>65</td>
<td>99</td>
<td>124</td>
</tr>
</tbody>
</table>
Some research numbers

- International conferences

<table>
<thead>
<tr>
<th>AC</th>
<th>AT</th>
<th>IC</th>
<th>IT</th>
<th>Totaal:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WOS</td>
<td>Andere</td>
<td>10</td>
<td>35</td>
<td>96</td>
</tr>
<tr>
<td>WOS</td>
<td>Andere</td>
<td>8</td>
<td>38</td>
<td>102</td>
</tr>
<tr>
<td>WOS</td>
<td>Andere</td>
<td>14</td>
<td>52</td>
<td>114</td>
</tr>
<tr>
<td>WOS</td>
<td>Andere</td>
<td>7</td>
<td>47</td>
<td>107</td>
</tr>
<tr>
<td>WOS</td>
<td>Andere</td>
<td>55</td>
<td>42</td>
<td>124</td>
</tr>
<tr>
<td>Andere</td>
<td>Andere</td>
<td>39</td>
<td>214</td>
<td>543</td>
</tr>
<tr>
<td>Totaal:</td>
<td>12</td>
<td>219</td>
<td>46</td>
<td></td>
</tr>
</tbody>
</table>
Enjoy your stay at our Technology Campus Gent
Co-operation with and courses for industry
09/09/2015, Ghent (Belgium)

Frederic Depuydt
Philippe Saey
Co-operation with and courses for industry

Introduction

• Personal view point, based on experience ... and intended for discussion!

? Do your universities provide courses/workshops/... for practicing engineers from industry?

Introduction

• It’s government policy!
• “Triple helix” of government, industry and academia

Co-operation with and courses for industry

• Introduction
• What does the industry expects to obtain from universities ... related to courses?
• What does the university expect to gain?
• Conclusions
• Example: web handling course
• Example: i-MOCCA interaction with industry
• Example: Profibus DP course
• Example: submitted project

Co-operation with and courses for industry

• What does the industry expects to obtain from universities, related to courses?
  – 😊 everything, from short low level to long high end courses ... at a very low price
  – sometimes a diploma or certificate if a course is followed ... but most of the time not at all (to suppress mobility of employees)
  – No exam at the end (at least for engineers), after all they volunteered to take the course
  – Well educated engineering students, that had contacts with industry
Co-operation with and courses for industry

What does the university expect to gain?

- In Belgium, universities have a triple mission:
  - Teaching
  - Research
  - Services to society
- What we do (related to courses for industry) should contribute to our goals => courses at high level, contributing to the courses/labs that we teach to our own students
- If possible a publication derived from that work (it is not the main focus of “services to society”…)
- If possible related to research projects
  - E.g. IWT often requires for cofinancing from industry (e.g. 92.5 % funding)
  - E.g. IOF (“Industrieel OnderzoeksFonds”), EU projects are demanding (more and more) industry as stakeholder (demand driven research, cofinancing, …) (we are in engineering, not in astronomy!)
  - Focus on SMEs (…)
- And ... well educated engineering students, that had contacts with industry (also refer to Germany, France … for engineering students that spend a semester in industry)

Conclusions

- Provide courses aimed at engineering level
  - The other levels do not contribute (directly) to our educational task
  - You enter the commercial market if you aim at other (lower) levels (for high level, the investment is very large)
- Be attractive ... search: 1) fast changing 2) industrially relevant topics
- Link to master thesis topics and master student projects, to make your MSc engineering education industrially relevant
- Link to government & EU priorities (EU 2020, focus on manufacturing industries
- And ... keep your specialization and profile!
Co-operation with and courses for industry

- Introduction
- What does the industry expects to obtain from universities ... related to courses?
- What does the university expect to gain?
- Conclusions
- **Example: web handling course**
- Example: i-MOCCA interaction with industry
- Example: Profibus DP course
- Example: submitted project

---

**Example: web handling course**

- Web handling course for steel industries
Co-operation with and courses for industry

Example: web handling course

• Company goal: keeping, spreading and deepening specific knowledge (company is ArcelorMittal Gent)
  – Applied to the winder after the cold steel rolling mill of Tandem 2 (OPH TD2)
  – Analyzing their actual control software structure & parameters, sensors & actuators

Example: web handling course
Co-operation with and courses for industry

Example: web handling course

- Keeping, spreading and deepening specific knowledge
  - Applied to one of their winders in the cold steel rolling mill (OPH TD2)
  - Analyzing their actual control software structure & parameters, sensors & actuators
  - Interactive course, using a complete Matlab/Simulink model with GUI and animation, with exercises on relevant fault situations (often generated by the model) (not possible in practice, causes and amount of mistuning are exactly known in the simulation).

- In co-operation with VUB, Prof. Ph. Lataire
- Immersion of our students and staff in the factory
- Related to courses of “electrical drive systems” and “control system design”
Co-operation with and courses for industry

Example: i-MOCCA contacts with industry

- i-MOCCA (see previous visits) is/was a successful 3 year Interreg IVa 2 Seas project, focused on industrial data communication and embedded control

<table>
<thead>
<tr>
<th>Item</th>
<th>Number of items</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensive courses (&gt; 1 day)</td>
<td>23</td>
<td>581</td>
</tr>
<tr>
<td>Workshops (1/2 day or 1 day)</td>
<td>37</td>
<td>1100</td>
</tr>
<tr>
<td>Lectures (20 min – 1 hr)</td>
<td>33</td>
<td>631</td>
</tr>
<tr>
<td>Papers / Book chapters</td>
<td>22</td>
<td>...</td>
</tr>
<tr>
<td>Articles for the general public</td>
<td>54</td>
<td>...</td>
</tr>
<tr>
<td>Non-technical lectures on the project</td>
<td>20</td>
<td>...</td>
</tr>
<tr>
<td>Companies reached</td>
<td>400+</td>
<td>...</td>
</tr>
<tr>
<td>Master or bachelor thesis</td>
<td>30+</td>
<td>30+</td>
</tr>
<tr>
<td>Demonstrators</td>
<td>22</td>
<td>...</td>
</tr>
</tbody>
</table>

1 The number of participants do not include the members of the project partners institutes
2 The number of people reached is not determined
3 Not relevant

Example: i-MOCCA contacts with industry

Example: a 4 day course for practicing engineers on Profibus DP

- “Profibus DP – Theory & Practice, Engineering and error finding” ...
  - ... is a 4 day high end course at engineering level on a major fieldbus, Profibus DP
  - ... developed for and in close co-operation with industry
  - ... very high interest from practicing engineers
- See the introductory presentation
Co-operation with and courses for industry

- Introduction
- What does the industry expects to obtain from universities ... related to courses?
- What does the university expect to gain?
- Conclusions
- Example: web handling course
- Example: i-MOCCA interaction with industry
- Example: Profibus DP course
- Example: submitted project

---

Co-operation with and courses for industry

Example: Submitted project “INCASE”

- “Towards Industry 4.0 via Networked Control Applications and Sustainable Engineering”
- Submitted as 3 year Interreg V 2 Seas project, decision October/November 2015
- It is ...
  - Demand driven (from industry)
  - In close co-operation with industry and professional organizations
  - Involves work of master students
  - Aimed at manufacturing industries, practicing engineers
  - Contains elements of the conversion towards Industry 4.0
  - Has a large number of green aspects (e.g. “ProfiEnergy”, energy saving via networked components, to be applied in the new future production line of Volvo Car Gent => demo?)
Co-operation with and courses for industry

Example: Submitted project “INCASE”

Work in progress …

PROFlenergy Setup for measurements

Lab Visit
&
Questions?
Upgrading technicians to engineers: bridge programme and distance learning

Guy Durinck

Higher engineering training for environmentally sustainable industrial development
543966-TEMPUS-1-2013-1-BE-TEMPUS-JPCR
HETES

Belgium: 2 types of engineering education

Master of Engineering Science
- 5 year programme
- Abstract thinking
- Applied scientific research
- PhD programme

Master of Industrial Sciences
- 4 year programme
- Less abstract
- Hands on approach
- PhD programme (relatively few students)
Master of Industrial Sciences
Standard programme at KU Leuven Technology Campus Ghent

- Master of Industrial Sciences: 4 years
  - Academic Bachelor
    - Common part (mathematics, physics, chemistry,…): 1,5 years
    - Specialised part (electronics, construction,…): 1,5 years
  - Master: 1 year
  - Postgraduate studies: 1 – 2 years
  - PhD programme: 4 years

What is a Professional Bachelor degree?

- Professional Bachelor
  - Most advanced technical degree at sub university level
  - 3 year programme
  - Very hands on approach
  - Little attention for science behind the technology
  - Technician
  - Very much in demand
  - Sometimes limited career perspective (e.g.: in big companies, in government agencies, etc…)
Options open to a Professional Bachelor

- Find a real job
- Bridge programme to Master of Industrial Sciences
- Other studies (options are limited)

Upgrading technicians to engineers

- From Professional Bachelors to Master
  - Bridge programme
  - Master degree

- Bridge programme
  - Engineering degree in the same field as the technical degree
  - Typical 60 credits (1 year)
  - Intensive courses in mathematics, sciences, basic engineering, etc…
The bridge programme is extremely popular
1 in 3 students that start in industrial sciences take this path

Philosophy behind the programme
- Practical training of a professional bachelor is excellent
- Need to work on basic scientific knowledge, attitude and skills
- Most important for engineering are mathematical knowledge and skills

Therefore:
- general mathematics courses are in the first semester: 9 credits
  (algebra, single and multivariate calculus)
## Bridge programme at KU Leuven Technology Campus Ghent

- **One bridge, two paths, two types of students**
  - Regular student
    - Majority of bridge programme students
    - 60 credits per year, 1 year programme
    - Takes daytime courses: sometimes together with academic bachelor students, sometimes special courses for bridge programme students
    - Mostly young people (<25 years old) who have recently graduated as Professional Bachelor
    - Limited or no work experience

## Bridge programme at KU Leuven Technology Campus Ghent

- **Distance learning student**
  - Mostly older people (>25 years old)
  - Significant work experience
  - Very often employed
  - Tries to combine work, family life (spouse, children, etc…) and studying for a master degree…

  - Maximum 40 credits per year (i.e.: minimum 3 years for bridge programme + master)
  - Must first successfully complete mathematics courses before he/she can take engineering courses
  - Studies at home, communicates with teachers via electronic learning environment
Bridging the gap

• All students tend to underestimate the bridge programme
• There is no easy way…

Bridge programme at KU Leuven Technology Campus Ghent

• Success rate for regular bridge programme students
  o About 50% (but many take more than 1 year)
  o Large differences between engineering disciplines
    • This is because of differences in secondary school education
    • Depending on secondary school education students gravitate to different technical fields (e.g.: professional bachelor in chemistry recruits people with good math and science skills)

• Success rate for distance learning students
  o About 10%
  o Combining work, family life, studying,… is NOT straight forward!
Bridge programme at KU Leuven Technology Campus Ghent

• Current challenges
  o Too many students that are not strong enough start
  o All students gravely underestimate the programme

• Solutions
  o Communicate in as many ways as possible that the programme is not for the faint of heart
  o Activate the students as soon as possible
    • Summer refresher course on secondary school mathematics
    • A final exam on part of the math package early in the academic year (November)

Bridge programme at KU Leuven Technology Campus Ghent

• Future challenge
  o Basic sciences and mathematics are being removed from the professional bachelor training (not sexy enough, not immediately usefull, etc…)
  o Bridging the gap will become a lot more difficult…

• Possible solution
  o Expand the bridge programme to 90 credits or more to include more basic sciences and mathematics (politically difficult)
  o Introduce online science courses that have to be completed succesfully before starting the bridge programme (will probably not work for the average student)
Thanks for your attention!
Green Light Flanders
Groen Licht Vlaanderen
2020

Catherine Lootens
KU Leuven – Technology campus Gent
Light & Lighting Laboratory
Project Officer
September 10, 2015
Agenda

• Who we are
• Motivation
• Knowledge transfer
• European Programs
  o Green Light Program
  o SSL-erate
Who we are?
Light&Lighting Laboratory

• Independant laboratory – supporting the lighting sector
• Research – Education – Services
• Today total staff: 20 people
  o Indoor lighting
  o Appearance of materials
  o Optical Design
  o New light sources

• www.lichttechnologie.be
Groen Licht Vlaanderen 2020

- The lighting sector in transition –

  - Previously focus on energy savings and holistic approach of lighting design
  - Now issues concerning transition phase (towards led and oled)
    + Research
    + Applying knowledge (= Studies, showcases, customized research…)

- 4 knowledge centers involved

- Several ‘hot’ lighting themes are covered

- Funded by IWT (80%) – agency for innovation by science and technology

- Controlled by companies (SME) – partnership within project (> 65 members – lighting industry, federations, universities, institutions)
  - Complete value chain is involved
  - Co-financing 20%

Catherine Lootens
Consortium Groen Licht Vlaanderen
Motivation
Still a great potential for energy savings

• The use, the installed power and consumption of artificial lighting can be minimized by an innovative concept including
  o Day lighting
  o Innovative lighting
    • High quality fixtures, light sources and gear – LED & OLED
    • Automation Implemented (DALI, wireless,….) + Occupancy and daylight sensors
    • Human Centric Lighting
  o Intelligent and holistic controlling
    • Artificial Light – illuminance – dimming/switching
    • Day light: Automatic sun blinds
    • Artificial Light quality (Color temperature, spectrum – mimic of spectrum sun)
    • HVAC
Share of lighting in total electrical consumption

- Depending on type of application and core business
  - 35-45% in offices, facility, retail and hotel and catering, industry
  - tot 70% in schools
  - ~30% in industry
  - ~16% in dwellings
- Potentials for saving
  - up to 50% (kW) and more…
- Realistic pay-back times:
  - Average 5 years
  - Depending on the “on” time
EPBD

• Energy Performance of Buildings Directive
• Huge impact of lighting on E-level

2015: E60
(or E54 – if no renewables)

Catherine Lootens
Energy savings with better lighting

• Minimizing power and ‘on time’ in combination with visual comfort
• 3 anchors
  o Daylight
  o Artificial light
  o Automation
LED lighting

- Energy efficient lighting
- Intelligent lighting
- Human centric lighting
- Internet of Things
- Power over Ethernet
- LiFi
- Way Finding
- Spectral control

- Standardization
- Colour consistency
- Flicker
- Compatibility to controls
- Definition of life time
- Glare control
Knowledge transfer
Knowledge research
Knowledge implementation
Knowledge transfer

Catherine Lootens
Knowledge research

- New light sources: led - oled
  - Towards a better led-luminaire
    - Perception of contrasts
      - Impact op lighting design
  - Intelligent controls
  - Glare control
  - Way Finding
  - Elderly people
  - Compatibility LED - Dimmers
    - Daylight controls
    - Energy savings

Catherine Lootens
Knowledge implementation

- Demonstration projects - From an innovation idea towards a practical model
- Opportunities - on demand studies
- Assistance on innovation implementation (for SME)
- (international) projects – (FP7 SSL-erate, iOLED, H2020)

Catherine Lootens
Knowledge implementation

- **Demonstration projects**
  - LED demonstration box on McAdam – colour consistency
  - Way finding set up – hospitals, stairs
  - Research setup on perception of contrasts
  - Compatibility lamps-dimmers
  - Demonstration room - glare
  - Demonstration box on colour rendering index – new metrics
Knowledge implementation

- **Study on demand**
  - Depreciation of a lighting installation
  - Lighting design software: Which maintenance factor to use with led?
  - Comparative studies on measuring equipment
    - For Colour and appearance measurements (materials)
    - For Light measurements (CCT, CRI, spectrum,..)
  - What about the use of led and the decolouration of meat
  - How does the colour temperature of led change?
    - In function of angle, dimming, time
    - Color consistency
  - What are pupil lumen?
  - What are eco -T5 lamps?
  - Flicker and driver frequency of led (dimming).
  - Led – lifetime, use time, maintenance factor

Catherine Lootens
Knowledge implementation

• **Consulting**
  o Technological support for SME
    • Assistance on innovation implementation
    • Members ‘Groen Licht Vlaanderen’ get 2 days free consulting (individual - customized)
    • Vb. Measurements, design, consulting
  o Feasibility studies SME
  o Proposals for (innovation) projects
  o Search for (international) partners -
Knowledge transfer – (promotie)

Knowledge research

Knowledge implementation

Knowledge transfer

General information - Courses

Lecturers/publications

Organisation of seminars/workshops

Innovation awareness of SME

Catherine Lootens
Knowledge transfer

- **Courses**
  - **Lighting Technology Specialization Course**
    - 3 modules – 1 evening/week – organized every 2 years – 25 weeks
    - Last edition 2014-2015: 25 students
    - 2015 – new start – several 2 days sessions (day programme) every 2 months
  - **DIALux (versus EN12464-1) – 2 day course**
    - 2013 – 5 editions – > 200 attendees
    - 2014 – 2 editions
    - 2015 – 2 editions – NEW software DIALux EVO
  - **Third party courses – ‘lighting’**
    - Consultants occupational hygiene, architects, facility managers, energy managers, …
  - **On demand for 1 company/federation/…**
- **GLV User Workshops (members) – 3 to 4/year**
- **GLV seminars, events, conferences,…**
  - Promotion Day Sustainable Lighting – 26 march 2015 (30 boots, 14 sessions – plenary + parallel, networking
  - Workshops during member reunions
  - Fall events Light&Lighting laboratory
- **Third party seminars, events, conferences,…**
- **Publications**

Catherine Lootens
OVERZICHT OPLEIDINGSAANBOD LICHTTECHNOLIGIE 2015-2016

- DIALUX EVO voor iedereen (Code: DIALux)
- Licht en verlichting in cijfers: de basiskennis (Code: Fotometrie)
- Kleur in cijfers: de basiskennis (Code: Colorimetrie)
- LED en Oleds let’s go! (Code: LED)
- Binnenverlichting: zinig en moei (Code: Binnenverlichting)
- Van lichtbron tot toestel: alles onder controle? (Code: Verlichtingsassistent)

<table>
<thead>
<tr>
<th>Code</th>
<th>Dag 1</th>
<th>Dag 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIALux</td>
<td>08/10/2015</td>
<td>13/10/2015</td>
</tr>
<tr>
<td></td>
<td>12/10/2015</td>
<td>19/10/2015</td>
</tr>
<tr>
<td>Fotometrie</td>
<td>13/10/2015</td>
<td>20/10/2015</td>
</tr>
<tr>
<td>Colorimetrie</td>
<td>08/12/2015</td>
<td>15/12/2015</td>
</tr>
<tr>
<td>Binnenverlichting</td>
<td>01/03/2016</td>
<td>01/03/2016</td>
</tr>
<tr>
<td>Verlichtingstoestel</td>
<td>15/05/2016</td>
<td>25/05/2016</td>
</tr>
<tr>
<td>LED</td>
<td>19/01/2016</td>
<td>06/04/2016</td>
</tr>
</tbody>
</table>

DOCENTEN
Laboratorium voor Lichttechnologie:
- Wouter Rycxnaert (DIALux, Binnenverlichting)
- Peter Hanselaer (Fotometrie)
- Frédéric Leloup (Colorimetrie)
- Yvon Meuret (LED)
- Guy Durack (Verlichtingstoestel)
- Catherine Lootens (Binnenverlichting)
Zij worden bijgestaan door collega's en externe gastsprekers uit de industrie.

Laboratorium voor Lichttechnologie
KU Leuven Technologiecampus Gent
Geboorders De Smetstraat 1
9000 Gent
Contact: info@lichttechnologie.be
(09) 265 87 13
www.lichttechnologie.be

http://www.lichttechnologie.be/overzicht/lichttechnologie/opleidingaanbod
Knowledge transfer

- Based on studies
  - Customized knowledge transfer
  - Previous Examples
    - RUE-grants: alternative criterion
    - LED-TL: endurance test+ specifications
    - Power factor: What does it really mean?
  - New examples
    - Induction lighting
    - Pupil lumen
    - Compatibility of light sources and dimmers
Knowledge Transfer

Vlaanderen.be

de officiële website van Vlaanderen

126 Publicaties

Energiezuinige verlichting voor kmo's (pakket van 2...)

AUGUSTUS 2014 - De brochure helpt kmo's om de knelpunten in de bestaande verlichtingsinstallatie op te sporen en maakt hen wegwijs in de uitvoering van een relighting.
Case study intelligent control

Daylight control system: screens and lighting.
Real energy reduction v claimed?
Long-term monitoring

Correct parameter in control system

<table>
<thead>
<tr>
<th>Month</th>
<th>Energy Savings (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>sept '13</td>
<td>10%</td>
</tr>
<tr>
<td>okt '13</td>
<td>8%</td>
</tr>
<tr>
<td>nov '13</td>
<td>1%</td>
</tr>
<tr>
<td>dec '13</td>
<td>9%</td>
</tr>
<tr>
<td>jan '14</td>
<td>3%</td>
</tr>
<tr>
<td>feb '14</td>
<td>5%</td>
</tr>
</tbody>
</table>

Hours sunshine:
- sept '13: 148
- okt '13: 110
- nov '13: 29
- dec '13: 87
- jan '14: 59
- feb '14: 71
Promotion Day - Sustainable Lighting
European Programs
GreenLight Program

• Voluntary pollution prevention initiative
• To encourage non-residential electricity consumers (public and private), referred to as Partners, to make a commitment towards the European Commission
• To install energy-efficient lighting technologies in their facilities
• When (1) it is profitable, and (2) lighting quality is maintained or improved.
Delhaize Belgium

Lighting electricity savings: **20 694 MWh/year**

Electricity use reduction: **more than 59%**

130 retail stores in Belgium have undergone improvements in lighting. The number of fluorescence and metal halide luminaires has been reduced and LED fixtures used systematically to replace standard halogen accent lighting and in refrigerated cabinets.
SSL-erate

Motivation

The uptake of Solid State Lighting in Europe has been slow:
Supply side: the industry and research community are fragmented, lack of standards, consistent quality, inter-operability;
Demand side: for buyers/users the benefits are not sufficiently clear

Substantial benefits to the society (environmental footprint, health & well-being aspects) do not sufficiently materialize

Collaboration is required to assure that the European industry creates added value
Objectives

Stimulate deployment of SSL: from energy saving to acceleration of ‘green’ business development

Accelerate innovation: analyze effects of biologically effective lighting on health and well-being

Stimulate open innovation to accelerate value creation:

Business development experiments in regional clusters for the most promising suggestions for green business development for enhancement of health and well-being.

Establish and facilitate a European innovation platform for networking & dialogue on SSL Innovation in Europe:

www.lightingforpeople.eu
D4.3 OPEN INNOVATION METHODOLOGY FOR ACCELERATED AND EFFECTIVE DEVELOPMENT AND DEPLOYMENT OF SSL

Accelerate SSL Innovation for Europe
Contact

- Contact:
  - KU Leuven, Technology campus Ghent
    - FIIW – Energy & Automation
    - Light & Lighting Laboratory
    - Gebroeders De Smetstraat 1, B-9000 Gent
  - Websites: [www.lichttechnologie.be](http://www.lichttechnologie.be) - [www.groenlichtvlaanderen.be](http://www.groenlichtvlaanderen.be)
  - email: info@groenlichtvlaanderen.be - info@lichttechnologie.be
  - Catherine Lootens (+32 9 2658713)
  - Downloads publications via [www.lichttechnologie.be](http://www.lichttechnologie.be)
Postacademic programme in Innovation and Entrepreneurship in engineering

The programme | concept

- 20 ECTS
  - Courses
    - Technical
    - Non-technical

- 40 ECTS
  - Innovation project
    - In-company project
    - Team project
    - Start-up project
**Programme** | focus on ...

Innovative project

Combination of technical specialisation and broadening courses

---

**Innovation project** | in-company project

- Accomplished by one or two students
- Duration is one semester (twice) or a whole academic year
- Innovative projects in a company = intrapreneurship
Innovation project | team project

- Accomplished by a team of students on campus
- Duration is one or two academic years
- Entrepreneurial students working on an innovative project

In the media | Flanders Today 25 October 2013

Students win Innovation Award with solar car

Leuven students win solar-powered car championship
Innovation project | start-up project

- Accomplished by a team of student on campus
- Duration is one or two academic years
- Students who start their own company

![Business Plan](image)

Study programme | personal

- Students compose their own study programme
- Interuniversity course list with broadening (non-tech) courses
- Approval needed from coach and faculty

![Course List](image)
Guidance university | coach

“The coach is a faculty member, alumni or relation and will be assisting the student (team) personally and process-wise during the whole length of the postgraduate programme. The coach provides personal advice to support the students’ learning process. During the innovation internship the coach is involved only process-wise and not – contrary to a Master’s thesis – in a technical manner or regarding the content. A coach stimulates innovation and enlarges the student (team) capability to be creative and innovative. The aim of coaching is to enlarge the personal effectiveness of the student. A coach is also an evaluator (together with a mentor).”

Project guide 2015 - 2016

Guidance company | innovation mentor

“The mentor is an experienced engineer or professional who is responsible for guiding the student (team) on the innovation project. The mentor keeps the student(s) focused on the project goals and is a technical entrepreneurial. He or she provides technical supervision during the innovation internship. The students look to the mentor as a role model. The mentor plays a vital role in both successful completion of the project and in the development of students into workforce-ready professionals. A mentor is also an evaluator (together with a coach).”

Project guide 2015 - 2016
"The difference between a Master’s thesis and an innovation project is that in the first one you have to prove you are an engineer, while in the second one you have to be able to function as an engineer."

"After the internship, the engineer is able to grow into the role more rapidly because we are familiar with his or her abilities. It’s also nice that the engineer has been bitten by the innovation bug, which is something that companies feel is important."

"This student received an excellent letter of recommendation from our CEO, which is seldom the case for student in a more ‘traditional’ internship."
Evaluation | learning outcomes

- Evaluation based on 4 main categories:
  - Entrepreneurship
  - Design, development and implementation
  - Lifelong learning
  - Communication and collaboration
- Product as well as process is evaluated
- Mid-term evaluation by mentor and coach
- Final evaluation by jury (incl. mentor and coach)

More info | contact

www.innovationentrepreneurship.be (students)
www.innovationinternships.be (companies)

Chrisje.Haenen@kuleuven.be
LESEC

Leuven Engineering and Science Education Centre

Johan Van den Bossche
LESEC: mission

… to contribute with research evidence to the advancement of engineering and science education.

This includes research and development activities, consultancy activities and the establishment of a network for cooperation, and exchange of experiences.”

Research teams

Learning communities
Science, Engineering and Technology Group

Faculty of Science

Faculty of Engineering Science

Faculty of Bioscience Engineering

Faculty of Engineering Technology

Faculty of Architecture
LESEC: mission

... to contribute with research evidence to the advancement of engineering and science education.

This includes research and development activities, consultancy activities and the establishment of a network for cooperation, and exchange of experiences.”

Research teams

Learning communities
Research team:

Conceptual understanding and problem solving

- Many students it’s difficult to acquire deep conceptual understanding
- How to improve conceptual understanding?
- Relation with problem solving?

Team Leader:
Mieke De Cock

PhD:
Pieter Coppens, Laurens Bollen

Other team members
Aldine Aeten, Jeroen Buijs, Riet Callens, Pieter Coppens, Johan Deprez, Pieter-Jan Drouillon, An Vanfroyenhoven, Johan Van den Bossche
Conceptual understanding and problem solving

\[ \nabla \cdot E = \frac{\rho}{\varepsilon_0} = 4\pi \kappa \rho \]

\[ \nabla \cdot B = 0 \]

\[ \nabla \times E = -\frac{\partial B}{\partial t} \]

\[ \nabla \times B = \frac{4\pi k}{c^2} J + \frac{1}{c^2} \frac{\partial E}{\partial t} \]

didn’t you understand?
Research team:

Incoming students and first year experience

Objectives:

• improving the study success of first year students in STEAM

• identification and implementation of valid instruments to assess knowledge and skills that are important for academic achievement.

• …

Team Leaders:
Carolien Van Soom, Tinne De Laet, Greet Langie

PhD:
Lynn Van den Broeck

Other team members
Bavo Meuwis, Margriet Ovaere, Maarten Pinxten, Johan Van den Bossche, Lynn Van den Broeck, Jef Vanderoost, Joos Vandewalle
Learning communities bring people together to set up permanent or temporary collaborations in the field of STEAM education

- use of web lectures
- use of video conferencing in a multi campus faculty
- Can elimination marking reduce the impact of risk-aversion in multiple choice assessments?
- Implementing OASE as an alternative curriculum design to improve learning.
- ....
Learning community: videoconferencing

I learn as much during a videoconferencing lecture as I do during a "live" lecture.

1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree
Learning communities

Use of video conferencing in a multi campus faculty

More videoconfering lectures should be organised, if this increases the volume of available courses

1=strongly disagree,
2=disagree
3=neutral
4=agree
5=strongly agree
More info?
http://set.kuleuven.be/LESEC

Leuven Engineering and Science Education Center (LESEC)

The overall objective of this center is to create within the University of Leuven a community of engineering and science education researchers in order to contribute with research evidence to the advancement of engineering and science education. This includes research and development activities, consultancy activities and the establishment of a network for cooperation, and exchange of experiences.

Read more.
readySTEMgo

Fighting increasing drop-out rates in the STEM field

Maarten Pinxten

International partners

Katholieke Universiteit Leuven (Belgium)

Technical University Hamburg-Harburg (Germany)

University of Žilina (Slovakia)

Budapest University of Technology and Economics (Hungary)

University of Birmingham (UK)

Aalto University (Finland)
Goals

Objective 1
Identification of key STEM competences
- Focus on first year
- Cognitive and non-cognitive aspects
- Early detection

Objective 2
Diagnostic instrument inventory
- Validated measures
- Predictive power on achievement
- Generalisibility

Objective 3
Identification of at risk students and target intervention
- Focus on aspects that offer specific targets for improvement
- Feedback to student
Educational system in Flanders

Flanders - Secondary school system

- 3 tracks in secondary education (grades 11 and 12)

- **Academic track**: General academic education → University
- **Technical track**: Technical education → University or University colleges
- **Vocational track**: Training in specific vocation → Labor market
Universities in Flanders

Flanders - Transition to university

- University: no entry requirements (except entrance exam for medicine & dentist)
- Only diploma secondary education (academic, technical or vocational track!)
- No central examination system (matura) at end of secondary school
- If students have diploma secondary school, they are eligible to subscribe at university, regardless of
  - GPA secondary school
  - Track
  - Study program at secondary school
### Engineering Technology - Academic track

<table>
<thead>
<tr>
<th>Study programme</th>
<th>N</th>
<th>%</th>
<th>CSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics - Languages</td>
<td>106</td>
<td>1,1%</td>
<td>28,5%</td>
</tr>
<tr>
<td>Economics - Sciences</td>
<td>68</td>
<td>0,7%</td>
<td>52,7%</td>
</tr>
<tr>
<td>Economics - Mathematics</td>
<td>241</td>
<td>2,5%</td>
<td>57,3%</td>
</tr>
<tr>
<td>Humanities</td>
<td>33</td>
<td>0,3%</td>
<td>35,7%</td>
</tr>
<tr>
<td>Latin - Sciences</td>
<td>206</td>
<td>2,2%</td>
<td>59,5%</td>
</tr>
<tr>
<td>Latin - Mathematics</td>
<td>420</td>
<td>4,4%</td>
<td>75,2%</td>
</tr>
<tr>
<td>Languages - Sciences</td>
<td>417</td>
<td>4,4%</td>
<td>52,0%</td>
</tr>
<tr>
<td>Languages - Mathematics</td>
<td>68</td>
<td>0,7%</td>
<td>69,1%</td>
</tr>
<tr>
<td>Sports</td>
<td>177</td>
<td>1,9%</td>
<td>44,8%</td>
</tr>
<tr>
<td>Sciences - Mathematics</td>
<td>4364</td>
<td>45,8%</td>
<td>71,2%</td>
</tr>
</tbody>
</table>


### Engineering Technology - Technical track

<table>
<thead>
<tr>
<th>Study programme</th>
<th>N</th>
<th>%</th>
<th>CSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bio-technical sciences</td>
<td>73</td>
<td>0,8%</td>
<td>45,0%</td>
</tr>
<tr>
<td>Construction</td>
<td>56</td>
<td>0,6%</td>
<td>45,6%</td>
</tr>
<tr>
<td>Chemistry</td>
<td>57</td>
<td>0,6%</td>
<td>35,4%</td>
</tr>
<tr>
<td>Electricity-Electronics</td>
<td>167</td>
<td>1,8%</td>
<td>52,9%</td>
</tr>
<tr>
<td>Electromechanics</td>
<td>264</td>
<td>2,8%</td>
<td>41,2%</td>
</tr>
<tr>
<td>Industrial Sciences</td>
<td>1981</td>
<td>20,8%</td>
<td>68,6%</td>
</tr>
<tr>
<td>ICT</td>
<td>55</td>
<td>0,6%</td>
<td>32,2%</td>
</tr>
<tr>
<td>Social and Technical Sciences</td>
<td>31</td>
<td>0,3%</td>
<td>8,6%</td>
</tr>
<tr>
<td>Technics-Sciences</td>
<td>734</td>
<td>7,7%</td>
<td>50,9%</td>
</tr>
</tbody>
</table>

Flanders - Positioning tests

- Introduced in 2013
- KU Leuven, Ghent University, University of Antwerp & Vrije Universiteit Brussel
- Science and engineering faculties
- Not obligatory (i.e., no consequences)
- Opportunity for students:
  1. To get an idea of the expected level of difficulty of a study programme
  2. Gauge their level in a particular domain relative to other students

www.ijkingstoets.be/

<table>
<thead>
<tr>
<th></th>
<th>Mathematics</th>
<th>Chemistry</th>
<th>Scientific reasoning</th>
<th>Academic language</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Sciences</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering Technology</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Bioscience Engineering</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Chemistry, Biology,</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Geography,…</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics, Physics</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Positioning test 2014-2015

- 120 students participated for Faculty of Engineering Technology (95 of them actually subscribed at KU Leuven)
- Majority of students comes from the academic track
- Math scores equal for academic track and technical track
- Language scores lower for technical track

Table 1. Relation with GPA exams January (N=95)

<table>
<thead>
<tr>
<th></th>
<th>Spearman rank correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>.49 **</td>
</tr>
<tr>
<td>Language</td>
<td>.08</td>
</tr>
<tr>
<td>Scientific reasoning</td>
<td>.12</td>
</tr>
</tbody>
</table>

** p < .01
Dual focus

Studies with quantitative approach
- Prediction of academic outcome variable at end of first year or BCs (GPA, CSE, or degree completion)
- Large-scale statistical analysis (e.g., regression)
- Importance of control for prior achievement (predictive power of one variable over another)

Studies with qualitative approach
- Drop-out studies
- Interviews/surveys of students who dropped out a STEM study

Completing the picture

**KNOWLEDGE**
- STEM domain specific knowledge (Math, chemistry, physics, biology)
- Verbal knowledge

**SKILLS**
- Hard skills
  - Critical thinking
  - Scientific literacy
  - Spatial ability
- Soft skills
  - Time-management
  - Effort regulation
  - Study strategies
  - ...

**ATTITUDES**
- Academic self-concept
- Motivation
- Goals
- Task & Utility value
- Test anxiety
Results quantitative studies: KNOWLEDGE

- Prior achievement in secondary school in a STEM domain (mathematics, chemistry or physics) is the most important and consistent predictor of study success.

- Prior verbal achievement: limited support for incremental predictive value over mathematics.

High prior achievement is a necessary but not sufficient condition for persisting in a STEM study programme.

Results quantitative studies: ATTITUDES

- Confidence in one’s academic competences (~academic self-concept) is the most important skill predictor of STEM study success (GPA and persistence).

- Intrinsic motivation is positively related to persistence in a STEM study program (not to GPA).

- Extrinsic utility (i.e., usefulness of studying engineering for reaching future goals) also positively related to persistence.

- Initial doubts are negatively related to persistence.
Results quantitative studies: SKILLS

- **Time-management** skills and **effort regulation** (i.e., ability to maintain effort when faced with challenging tasks) are positively related to persistence in STEM study program

- **Deep learning strategy**: positively related to GPA

- In sum:
  - Less frequently investigated
  - Predictive value of hard skills over knowledge?
  - Smaller effects compared to knowledge and attitudes

Results qualitative studies

- ‘Stayers’ & ‘Switchers’: similar problems

- Not one overwhelming problem but longitudinal push-pull process

- Role of coping strategies (e.g., not taking displays of indifference personal) in order to
  1. Sustain their motivation
  2. Maintain their interest
  3. Insulate them from losing self-confidence
Discussion

<table>
<thead>
<tr>
<th></th>
<th>Knowledge</th>
<th>Skills</th>
<th>Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Prediction</td>
<td>+++</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>2. Improvement</td>
<td>+++</td>
<td>++</td>
<td></td>
</tr>
<tr>
<td>3. Feedback</td>
<td>+++</td>
<td>++</td>
<td></td>
</tr>
<tr>
<td>4. Transfer</td>
<td>+</td>
<td>+++</td>
<td>++</td>
</tr>
</tbody>
</table>

Challenges international collaboration

- International context: different educational contexts
  - Some institutions rigorous selection criteria
  - Different positioning initiatives at different institutions
  - Different entry requirements

- Large differences in study programmes

- Differences in teaching staff
  - Students tutors
Results first year student survey at KU Leuven

Goal

- Identify stumble blocks of first year students in a STEM study programme
- 49 items
- Broad range of topics was covered (transition secondary education, curriculum, work load, study strategies, …)

<table>
<thead>
<tr>
<th></th>
<th>Invited (n)</th>
<th>Respondend (n)</th>
<th>Response %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>2021</td>
<td>857</td>
<td>42%</td>
</tr>
<tr>
<td>Bio-engineering</td>
<td>274</td>
<td>93</td>
<td>34%</td>
</tr>
<tr>
<td>Engineering Science</td>
<td>524</td>
<td>253</td>
<td>48%</td>
</tr>
<tr>
<td>Engineering Technology</td>
<td>908</td>
<td>366</td>
<td>40%</td>
</tr>
<tr>
<td>Sciences</td>
<td>315</td>
<td>145</td>
<td>46%</td>
</tr>
</tbody>
</table>
Prior math achievement secondary school

<table>
<thead>
<tr>
<th>Category</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 70% math GPA Secondary school</td>
<td>289</td>
<td>33.7%</td>
</tr>
<tr>
<td>70-85% math GPA Secondary school</td>
<td>461</td>
<td>53.8%</td>
</tr>
<tr>
<td>&gt; 85% math GPA Secondary school</td>
<td>107</td>
<td>12.5%</td>
</tr>
</tbody>
</table>

Goals and career perspective

4. I have a clear career goal of what I want to achieve with my current study programme

- Agree: 41%
- Agree nor not agree: 26%
- Not agree: 33%

20. Most courses in my programme are relevant to my future career plans

- Agree: 56%
- Agree nor not agree: 31%
- Not agree: 13%

6. I was 100% certain of the study programme I chose at the beginning of the academic year

- Agree: 59%
- Agree nor not agree: 18%
- Not agree: 23%
Transition secondary school

11. During the academic year, I managed to integrate with my peer/fellow students

- Agree: 84%
- Agree nor not agree: 11%
- Not agree: 5%

17. The transition from secondary school to university was easy for me

- Agree: 42%
- Agree nor not agree: 36%
- Not agree: 22%

KU LEUVEN
Prior knowledge

10. I did not have enough prior knowledge to be successful in my current study programme

- Agree: 16%
- Agree or Not Agree: 18%
- Not Agree: 66%

27. I was sufficiently prepared for my current curriculum by my study programme in secondary education

- Agree: 63%
- Agree or Not Agree: 19%
- Not Agree: 18%

Motivation & self-confidence

1. I feel motivated to be successful in my studies and to become a scientist/engineer

- Agree: 88%
- Agree or Not Agree: 8%
- Not Agree: 4%

32. I became demotivated because of the difficult course content

- Agree: 16%
- Agree or Not Agree: 32%
- Not Agree: 53%

42. I lost my motivation because of bad results

- Agree: 20%
- Agree or Not Agree: 17%
- Not Agree: 63%

16. I lost my confidence in myself because of poor grades

- Agree: 24%
- Agree or Not Agree: 18%
- Not Agree: 57%
Motivation and self-confidence

42. I lost my motivation because of bad results

<table>
<thead>
<tr>
<th>Mathematics SE</th>
<th>Agree</th>
<th>Agree nor not agree</th>
<th>Not agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;85%</td>
<td>9%</td>
<td>7%</td>
<td>84%</td>
</tr>
<tr>
<td>70-85%</td>
<td>18%</td>
<td>16%</td>
<td>67%</td>
</tr>
<tr>
<td>&lt;70%</td>
<td>28%</td>
<td>24%</td>
<td>48%</td>
</tr>
</tbody>
</table>

Motivation and self-confidence

16. I lost confidence in myself because of bad grades

<table>
<thead>
<tr>
<th>Mathematics SE</th>
<th>Agree</th>
<th>Agree nor not agree</th>
<th>Not agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;85%</td>
<td>10%</td>
<td>11%</td>
<td>79%</td>
</tr>
<tr>
<td>70-85%</td>
<td>23%</td>
<td>19%</td>
<td>58%</td>
</tr>
<tr>
<td>&lt;70%</td>
<td>31%</td>
<td>20%</td>
<td>49%</td>
</tr>
</tbody>
</table>
Workload

3. The workload is too high

- AGREE: 36%
- AGREE NOR NOT AGREE: 45%
- NOT AGREE: 19%

40. I have to study harder than anticipated

- AGREE: 47%
- AGREE NOR NOT AGREE: 28%
- NOT AGREE: 25%

Curriculum

14. Most courses in my programme are too theoretical/abstract

- AGREE: 23%
- AGREE NOR NOT AGREE: 35%
- NOT AGREE: 42%

18. Most courses in my programme are interesting

- AGREE: 83%
- AGREE NOR NOT AGREE: 11%
- NOT AGREE: 6%

29. Most courses of the programme were in line with my expectations

- AGREE: 70%
- AGREE NOR NOT AGREE: 23%
- NOT AGREE: 7%

31. In general, I feel satisfied with the quality of the lectures, practical (exercise) sessions, and laboratory sessions

- AGREE: 73%
- AGREE NOR NOT AGREE: 18%
- NOT AGREE: 9%
Curriculum

35. The courses of the programme are too difficult.

- Agree: 11%
- Agree nor not agree: 44%
- Not agree: 46%

43. It is clear to me how most courses can be practically applied.

- Agree: 55%
- Agree nor not agree: 28%
- Not agree: 18%

Study strategies

7. Developing a study schedule (e.g., a weekly planning) is easy for me

- Agree: 38%
- Agree nor not agree: 29%
- Not agree: 34%

22. I easily managed to develop an efficient learning strategy

- Agree: 30%
- Agree nor not agree: 37%
- Not agree: 33%

24. I use a planning (study schedule) during the examination period

- Agree: 61%
- Agree nor not agree: 16%
- Not agree: 23%
Study strategies

22. I managed to develop an effective study strategy

- >85% MATHEMATICS SE (N=107): 43% Agree, 35% Agree nor not agree, 22% Not agree
- 70-85% MATHEMATICS SE (N=461): 37% Agree, 33% Agree nor not agree, 30% Not agree
- <70% MATHEMATICS SE (N=289): 43% Agree, 38% Agree nor not agree, 19% Not agree

Study strategies

28. The learning strategies I used in secondary school proved to be inefficient at university

- Agree: 52%
- Agree nor not agree: 22%
- Not agree: 26%

30. During this academic year I had problems developing effective study skills

- Agree: 49%
- Agree nor not agree: 26%
- Not agree: 25%

47. I have difficulties integrating different sources of course material (slides, exercises, text book, online content,...) when studying

- Agree: 49%
- Agree nor not agree: 26%
- Not agree: 25%
Study strategies

28. The learning strategies I used in secondary school proved to be inefficient at university

- >85% MATHEMATICS SE (N=107): 24% agree, 37% agree not agree, 39% not agree
- 70-85% MATHEMATICS SE (N=461): 23% agree, 26% agree not agree, 51% not agree
- <70% MATHEMATICS SE (N=289): 20% agree, 23% agree not agree, 57% not agree

Study strategies

30. During this academic year, I had troubles developing effective study skills

- >85% MATHEMATICS SE (N=107): 30% agree, 28% agree not agree, 42% not agree
- 70-85% MATHEMATICS SE (N=461): 25% agree, 27% agree not agree, 48% not agree
- <70% MATHEMATICS SE (N=289): 16% agree, 27% agree not agree, 57% not agree
Time management skills

9. Finding a good balance between my studies and leisure is easy for me

- Agree: 27%
- Agree nor not agree: 28%
- Not agree: 45%

26. I do not have sufficient self-discipline

- Agree: 44%
- Agree nor not agree: 25%
- Not agree: 32%

36. I spend enough time on my studies

- Agree: 50%
- Agree nor not agree: 25%
- Not agree: 26%

48. I have problems to start studying

- Agree: 56%
- Agree nor not agree: 18%
- Not agree: 26%

26. I do not have sufficient self-discipline

- >85% MATHEMATICS SE (N=107):
  - Agree: 28%
  - Agree nor not agree: 71%
  - Not agree: 51%
- 70-85% MATHEMATICS SE (N=461):
  - Agree: 26%
  - Agree nor not agree: 40%
  - Not agree: 35%
- ≤70% MATHEMATICS SE (N=289):
  - Agree: 24%
  - Agree nor not agree: 20%
  - Not agree: 56%
Time management skills

36. I spend enough time on my studies

- >85% MATHEMATICS SE (N=107)
  - Agree: 69%
  - Agree nor not agree: 15%
  - Not agree: 16%

- 70-85% MATHEMATICS SE (N=461)
  - Agree: 53%
  - Agree nor not agree: 24%
  - Not agree: 23%

- <70% MATHEMATICS SE (N=289)
  - Agree: 37%
  - Agree nor not agree: 30%
  - Not agree: 33%

48. I have problems to start studying

- >85% MATHEMATICS SE (N=107)
  - Agree: 33%
  - Agree nor not agree: 47%
  - Not agree: 19%

- 70-85% MATHEMATICS SE (N=461)
  - Agree: 54%
  - Agree nor not agree: 29%
  - Not agree: 17%

- <70% MATHEMATICS SE (N=289)
  - Agree: 68%
  - Agree nor not agree: 20%
  - Not agree: 12%
Support

12. I feel I can contact the university counseling service or personal tutor in case of study related problems (e.g., performance anxiety, ineffective study strategies or problems with study planning)

- Agree: 71%
- Agree nor not agree: 22%
- Not agree: 8%

13. I received sufficient helpful feedback this year (e.g., oral feedback, written feedback on assignments or lab reports, grades, or trial exams)

- Agree: 46%
- Agree nor not agree: 28%
- Not agree: 25%

Conclusion – The good

- 71% of the students feels supported by the student guidance counseling services
- 81% of the students manages to integrate with is his/her peers
- 88% feels motivated to become an engineer
- 83% considers the courses in the first year interesting
- 73% feels satisfied with the quality of the lectures, lab sessions, etc.
Conclusion – The bad

- 44% reports that transition from secondary school to university is difficult
- 47% reports that they have to study harder than anticipated
- 18% felt insufficiently prepared by secondary education
- 1/3rd of students has difficulties developing an efficient study strategy during the first year
- 45% reports problems finding a balance study-leisure
- 56% reports problems to start studying

Discussion – At risk?

- Prior achievement: General tendency but degree of uncertainty
- Uncertainty of other factors (e.g., time management skills, self-regulatory skills, etc…) is even bigger
- 100% conclusive instrument doomed to fail!
- Measurement issues
  - Example: critical thinking skills
    1. Domain specificity
    2. Generally measured with open ended questions
    3. Labor intensive scoring process
Raising awareness among students

- We developed a brochure for students

   http://iiw.kuleuven.be/english/readystemgo/activities


Thanks for your attention!

Maarten.Pinxten@kuleuven.be

Erasmus+ Strategic Partnership 2014-1-BE02- KA200-000462