

# MODERNISATION OF ENGINEERING EDUCATION BY THE NETWORK OF HEIS FOR AUTOMOTIVE INDUSTRY

*Maria Kocsis Baán*

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Cooperation between higher education, research institutes and automotive industry  
section

# Content

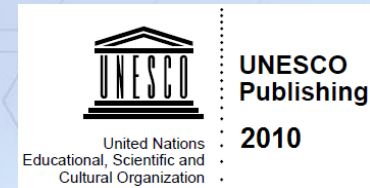
- Modernisation of engineering HE - Why? What? How?
- Best practice examples – exploration and exploitation of opportunities and resources
  - EU Lifelong Learning projects
    - Networks of HEIs
    - University-Business cooperation, role of professional organisations
  - Open Educational Europa – initiative of European Commission
  - ERASMUS+
- Expected outcomes of the sub-project – gateway portal for sharing information and experiences, networking
- Conclusions

## Modernisation of engineering education - Why?

- World-wide recognition of Hungarian scientists and engineers – do we need changes at all?
- Factors of competitiveness
- Feedback from Industry – can we /should we reflect on their needs?
- New challenges, changing priorities in engineering practice
  - Internationalisation
  - Globalisation
  - Incredible speed of technological development
  - Versatility of needs... and many more...

# Engineering: Issues, Challenges and Opportunities for Development

UNESCO Report, published in 2010



- **New model of International Education of Engineers**
- ***The need for a change in engineering education***
  - Increasing demand for engineers who are able to work anywhere in the world and who can work on global engineering projects and problems.
  - Changing priorities in engineering practice will require corrections and perhaps more fundamental and painful transformations of educational programmes, the profiles of teaching faculty, and the organizational structures of institutions.
- ***The potential is given by:***
  - the number of academics and universities with international experience in engineering and engineering education;
  - the volume of knowledge and lessons learned from international engineering projects;
  - the technologies available to facilitate international education; and
  - the growing experience with international students and the exchange of students and teachers.



# WHAT?

- Professional content
- Range, level and deepness of required knowledge and/or competences at BSc, MSc level
  - „What should the proportions of general and specialist technological knowledge be?
  - What should the proportions of technological and nontechnological knowledge be (including economics, management, ethics, humanitarianism) for a modern engineer?” UNESCO Report
- Diversity of competencies to be gained for working at
  - a multinational firm – team work, multicultural competencies, management skills
  - an SME – independency and creativity, practice oriented and applicable knowledge on the specific field.

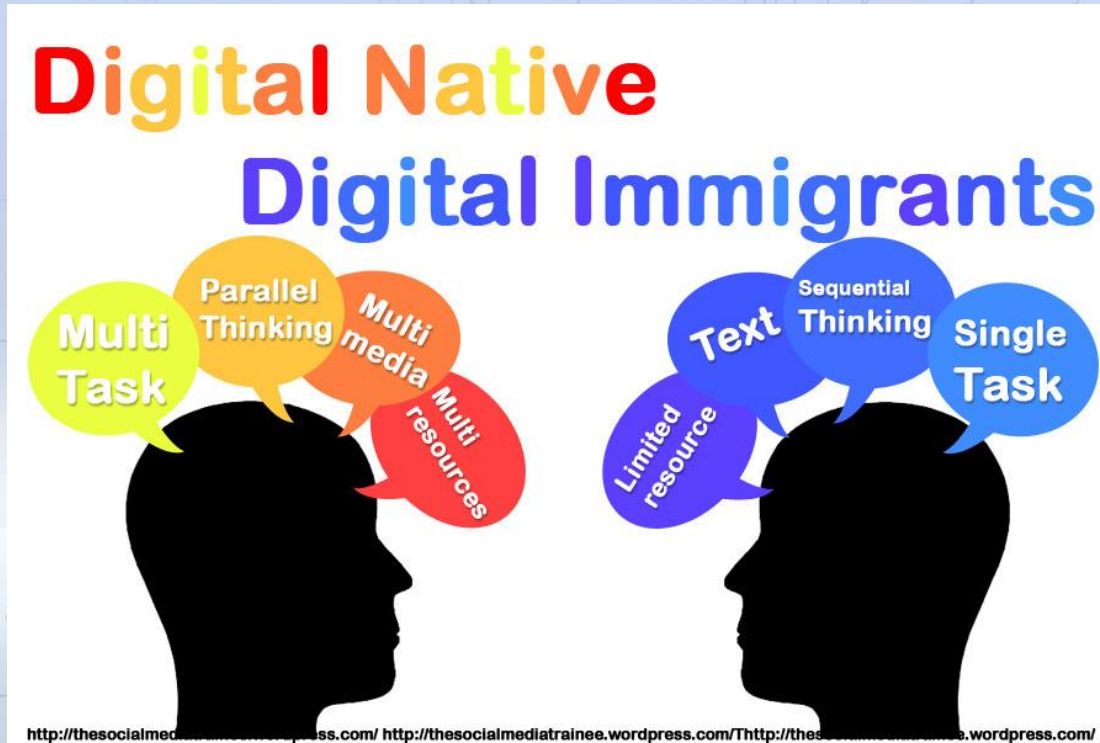
## What or HOW to teach?

- Could we define **what knowledge our students need for their whole professional carrier** – i.e. from graduation till 2050 or further?

Evidently NOT – so why we focus on **WHAT** to teach, and why not on HOW to teach them for being prepared for

- Following the change, the dynamic development,
  - Finding, selecting, understanding, interpreting and applying the information available in several resources?
- Is teaching „transfer of knowledge“?
  - Are teachers the „sources“ and „broadcasters“ of transferable knowledge or rather the facilitators of learning?
  - Can we use „old-style“ educational technologies effectively for teaching the Digital Native generation?

## What is the difference?



- Are we prepared for changes?
- And are we inspired/motivated?

If yes, here are some guides/helps

## Teaching Engineering

All you need to know about  
engineering education but were  
afraid to ask

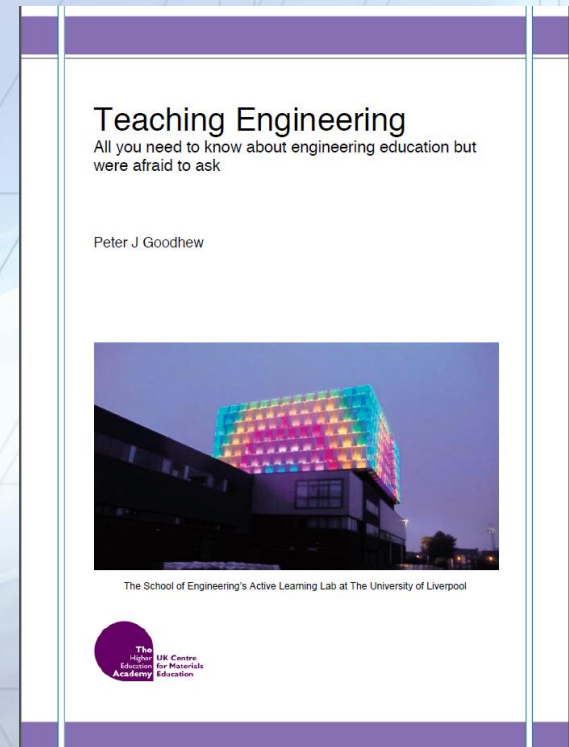
- By Peter Goodhew

former Director of UK Centre for  
Materials Education

2010

download:

<http://www.materials.ac.uk/>





# Gateway Portals for further resources

## Materials.ac.uk

The front page of this site and resources on it are maintained by the Engineering and Materials Education Research Group (EMERG) at the University of Liverpool, formally UKCME.

The following pages are archived, and are no longer being updated.

- About UKCME
- Events and Workshops
- Current Projects
- Database of Resources
- Funding Opportunities
- Important Themes
- Articles and Publications
- Further Education
- For Schools
- For Students
- For Employers
- Cymraeg
- Help


The UKCME was a subject centre of the Higher Education Academy.

### UKCME and EMERG

'The UKCME supports high quality student learning in materials science and related disciplines. It promotes, encourages and coordinates the development and adoption of effective practices in learning, teaching and assessment.'


What can we do for you?  
What is Materials Science?

### In the Spotlight



The UKCME have updated the National Subject Profile. [Click here to view the updated version](#)

### Teaching Engineering



Teaching Engineering  
Free book by Peter Goodhew  
Available online  
Click Here

### Matter Content Packages



A number of key modules from **MATTER** have been converted for use in **online distance learning** or in a **Virtual Learning Environment**, including:

- Introduction to Crystallography
- Introduction to Electrons in Crystals
- Introduction to Point Defects
- Introduction to Phase Diagrams
- Introduction to Electron Microscopes

[Click here to see the available modules](#)  
[Click here to go to the MATTER website](#)

### Projects and Websites

In the pipeline:

**CORE-SET**  
Engineering OER resources taken from industrial partners

**IntoEngineering**  
Promotional quiz and information site for the engineering discipline

Up and running:

**Kritikos**  
Customised search engine for visual media relevant to Engineering Education

**CORE Materials**  
Open Educational Resource repository for Materials Science

**Materials Classroom**  
Educational games for schools and colleges in materials science

### Guides for Lecturers

The 'Guides for Lecturers' have been reworked into a single book.

To download the book click the link below:

**Teaching Materials Engineering**

This book updates the relevant information from the guides as well as new information relevant to teaching materials engineering. Use this instead of the files below, which are here only as legacy material.



10 The Higher Education Academy UK Centre for Materials Education  
Celebrating 10 years of enhanced teaching and learning



HOME OF OPEN EDUCATIONAL RESOURCES IN MATERIALS SCIENCE



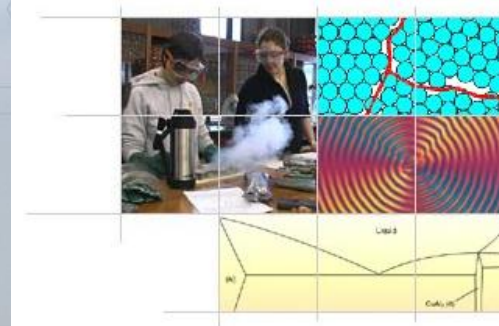
HOME OF OPEN EDUCATIONAL RESOURCES IN MATERIALS SCIENCE




worldsteel  
ASSOCIATION



steeluniversity.org



Teaching and Learning Packages  
Micrograph Library  
Video Library

About DoITPoMS  
Dissemination  
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# Open Educational Resources

## CORE-Materials

COLLABORATIVE OPEN RESOURCE ENVIRONMENT – FOR MATERIALS



Open Educational Resources

HOME | ABOUT | MATERIALS & REPORTS | CONTACT | HELP | RESOURCE FINDER

### Latest News

Resources on Novel Materials, including quasicrystals from AMES Lab

Materials breakthrough - resources on graphene added

Forming and Testing Techniques for Composite Materials

### Have you seen...?

Animation of aluminium extrusion process

Restoring a tooth video

The role of technology in sporting performance lecture

### User comments

"Thank you for the CC license, I used this for an article, on [www.labgrab.com](http://www.labgrab.com). Great image." [LabGrab on Flickr](#)

"Thank you for help me to understand this technique. Reading about it just wasn't enough to really understand it. Great narration and nice camera work!" [mapple34 on YouTube](#)

"WOW! I could have saved an entire 12 hour day had I found this first," [inventorgrissom on SlideShare](#)

### Follow us on...

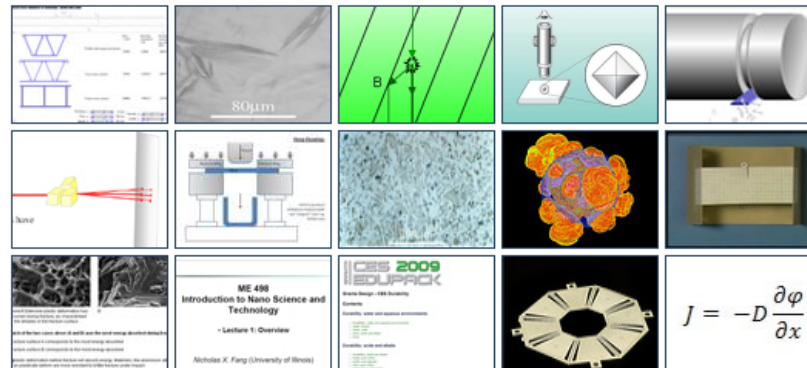


The CORE-Materials repository contains 1662 open educational resources (OERs) in Materials Science and Engineering, freely available under a range of [Creative Commons](#) licenses. It currently contains:

-  25 datasets
-  937 images
-  226 interactive resources
-  1 software
-  1 sounds
-  175 texts
-  55 presentations
-  160 videos/animations
-  50 equations
-  2 external websites

It also contains 132 copyrighted resources, which you might find useful.

I'm looking for resources on   [leave blank to see all resources](#)



Click on the images to view resource details

# Materials Education Symposia – and many more...



## Materials Education Symposia

### 2014 Symposia

▶ Home

Organization

Call for Abstracts

Themes

5th N. American Symposium

6th International Symposium

1st Asian Symposium

Previous Symposia

Contact Details



**Key events for materials educators in undergraduate engineering, design, and science**

**Main Theme: 'Materials, Systems, Innovation, & Sustainable Development'**

**Poster allocations now being made: final submission deadline Feb 15 »**

Confirmed participants include: John Abelson (UIUC), Mike Ashby (Cambridge), Yves Bréchet (INP-Grenoble), Rudolph Buchheit (Ohio State), Bill Callister (Utah), David Embury (McMaster), Peter Goodhew (Liverpool), Mark Miodownik (UCL), Srinivasa Ranganathan (IISc Bangalore), and Rick Sisson (WPI).

Event details	Presentations	Details and Registration
<b>5th North American Materials Education Symposium</b> University of Illinois at Urbana-Champaign, March 20-21, 2014	<a href="#">Speaker Program »</a>	<a href="#">Here »</a>
<b>6th International Materials Education Symposium</b> University of Cambridge, UK, April 10-11, 2014	<a href="#">Speaker Program »</a>	<a href="#">Here »</a>
<b>1st Asian Materials Education Symposium</b> National University of Singapore, Dec 11-12, 2014	<a href="#">Call for abstracts »</a> (by May 31, 2014)	<a href="#">Here »</a>

### Education

▶ Overview

CES EduPack

Teaching Resources

Events & training

Granta for research

Background

Support & FAQ

Interact with Granta

**GRANTA** | **CES 2013**  
**EDUPACK**

▶ **INFORMATION PACK AND PRESENTATION**

▶ **SEE A DEMONSTRATION**



# Open Education Europa

## Courses

### Filter by Subject:

- Social sciences (101)
- Applied sciences (76)
- Science and technology (73)
- Humanities (69)
- Mathematics and statistics (42)
- Natural sciences (34)
- Business (26)
- Arts (13)

### Filter by Level

- Higher Education (364)
- Vocational Education and Training (93)
- Adult Learning (70)
- Secondary (31)
- Primary (14)

### Filter by Language:

- English (213)
- Spanish (57)
- French (25)
- German (23)
- Dutch (14)
- Portuguese (14)
- Italian (13)
- Finnish (6)
- Polish (6)
- Slovak (5)
- Estonian (4)
- Hungarian (4)
- Latvian (4)
- Czech (1)
- Greek (1)
- Maltese (1)

### Filter by License

- Not acknowledged (186)
- Attribution Non-Commercial Share Alike (CC BY-NC-SA) (145)
- Attribution

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## Open Education Europa

The gateway to European innovative learning

EUROPA > Open Education Europa > Home > Find > Courses

[SIGN UP](#) | [LOGIN](#)

### Find

[Courses](#) | [MOOCs](#) | [Resources](#) | [Institutions](#)

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### In-depth

[eL Papers](#) | [EU Projects](#) | [News](#) | [Articles](#)

**Search:** You are looking for  [Advanced Search](#)

Refine your results    Showing 1 - 4 of 4 results    10 Results per page    Sort by:

**I'm looking for Courses**

Filter by Subject:

Applied sciences (4)

Filter by Level:

Higher Education (4)

Filter by Institution:

Select an option

Filter by Language:

Hungarian

Filter by License:

Not acknowledged (4)



**Műszaki felülettechnológiák - adaptáció a MinSE nemzetközi MSc képzési program tananyagából**  
Institutions: University of Miskolc

Korábbi nemzetközi projektjeink keretében, nemzetközi szakértői hálózat együttműködésében fejlesztett tananyagelemek adaptációjával arra törekedtünk, hogy a nyelvi korlátok...

Subject: [Applied sciences](#)



**Korszerű alakíthatósági vizsgálatok**  
Institutions: University of Miskolc

A finomlemezeket széles körben alkalmazzák a feldolgozóiparban: a készterméket gyakran bonyolult alakító műveletek sorozatával dolgozzák fel.

Subject: [Applied sciences](#)



**Ipari káresetek elemzése**  
Institutions: University of Miskolc

A műszaki alkotások (szerkezetek) elhasználódása, leromlása, értékcsökkenése megállíthatatlan és általában visszafordíthatatlan folyamat.

Subject: [Applied sciences](#)

**Share your knowledge**

Propose content!:

Select an option

Submit now

**LATEST MEMBERS ACTIVITY**



Christopher Pappas posted **Top 10 eLearning Stats for 2014 - Infographic** in blogs

 CDDP de l'Oise posted **Des livres que tu peux télécharger, lire, échanger, utiliser pour tout ce qu'il te plaira (+ 100 000 livres en ligne)** in blogs



## European projects in engineering fields

- **Establishment of new courses on Materials Engineering in Hungary (1994-97)**
- **Innovate – Surface Engineering (2001-2004)**
- **E2ngineering – MatSci and CAE, (2004-2006)**
- **MinSE – Heat Treatment & Surface Engineering (2006-2009)**



## Common strengths, innovative aspects

- International **networking models**,
- **Multilingual delivery** of the content – versatile, simultaneous language support
- **Resource based** approach in course development
- Developing training materials in modular structure – **reusable learning elements**, as building blocks of different learning programmes – a „LEGO” system of course development

Gradual, step-by-step investment,  
continuous improvement  
Cost effectiveness - remixing of existing,  
shared resources



# Examples of learning elements – edited video-lectures

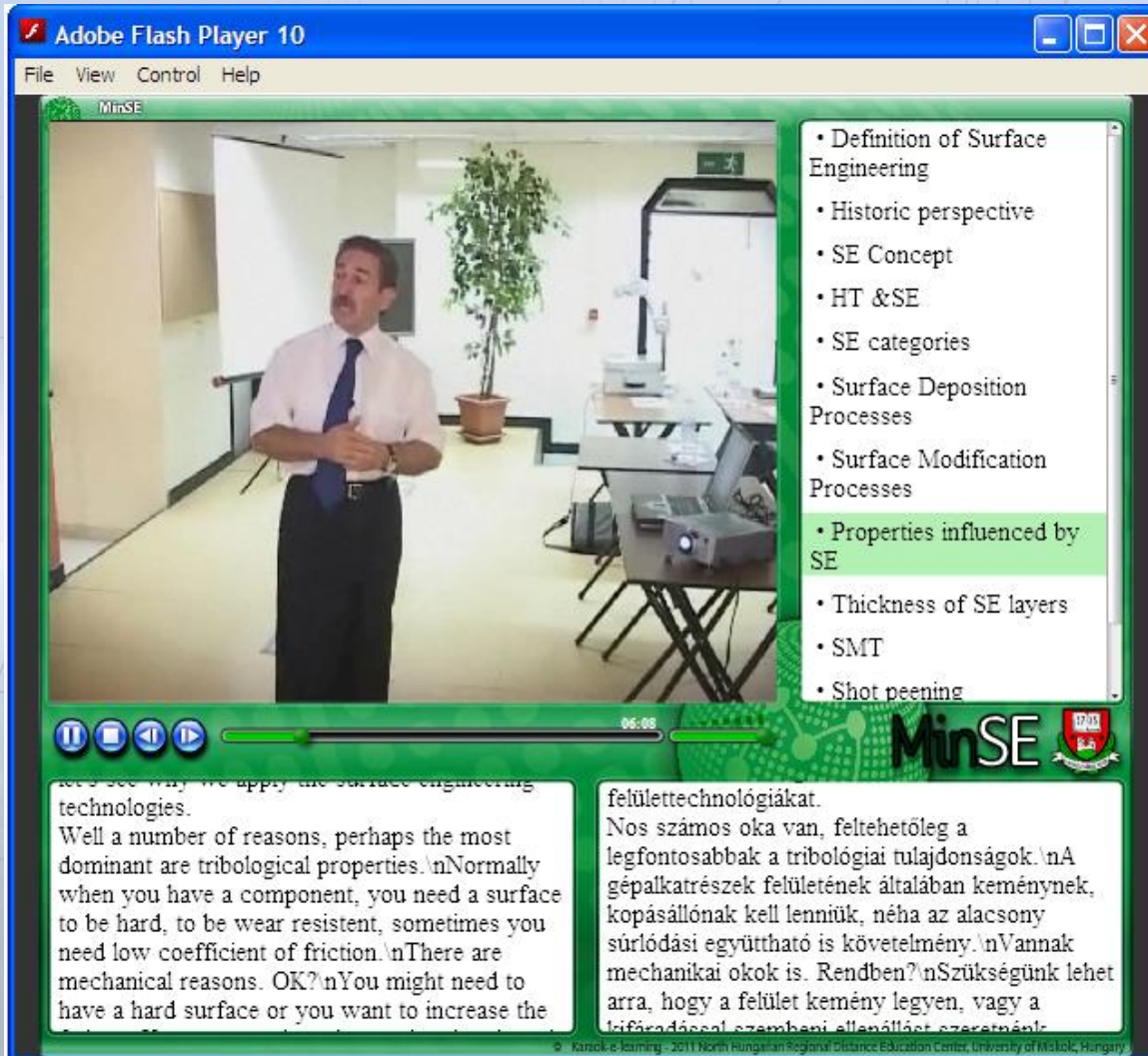
The screenshot shows a video player interface. The top menu bar includes 'Fájl', 'Szerkesztés', 'Nézet', 'Kedvencek', 'Eszközök', and 'Súgó'. The address bar shows the file path: 'C:\\_DEMO\_prezi\108\_katar\_dvd\platform\_free\tom\_bell\tbell\_files\default.htm'. The video content displays a presentation slide with the following elements:

- INNOV@TE** logo on the left.
- Production Gas Carburising - Theory and Practice** title in the center.
- Logos for the **European Union** and **Education and Culture Leonardo da Vinci** program on the right.
- A video thumbnail on the left shows Prof. Tom Bell speaking at a podium. Below it is a video control bar with a play button, a progress indicator at '0:11:16 / 0:29:53', and standard playback controls.
- The main slide content is titled 'Examples of carburising applications' and features two images of gears: a close-up of a brass gear and a black and white image of a steel gear.
- A list of topics is visible at the bottom left of the slide:
  - Production Gas Carburising
  - Today You should learn
  - Principal Surface Engineering P...
  - Thickness of coatings and dept...
  - Typical thermochemical process
  - Carburising Methods
- The slide number '28' is in the bottom right corner.

Presentation of late Prof. Tom Bell, University of Birmingham



# Video-lecture - subtitled in English and Hungarian



**Adobe Flash Player 10**
  
 File View Control Help

MinSE

- Definition of Surface Engineering
- Historic perspective
- SE Concept
- HT & SE
- SE categories
- Surface Deposition Processes
- Surface Modification Processes
- Properties influenced by SE
- Thickness of SE layers
- SMT
- Shot peening

06:08

MinSE

let's see why we apply the surface engineering technologies.  
 Well a number of reasons, perhaps the most dominant are tribological properties.  
 Normally when you have a component, you need a surface to be hard, to be wear resistant, sometimes you need low coefficient of friction.  
 There are mechanical reasons. OK?  
 You might need to have a hard surface or you want to increase the

felülettechnológiákat.  
 Nos számos oka van, feltehetőleg a legfontosabbak a tribológiai tulajdonságok.  
 A gépalkatrészek felületének általában keménynek, kopásállóknak kell lenniük, néha az alacsony súrlódási együttható is követelmény.  
 Vannak mechanikai okok is. Rendben?  
 Szükségünk lehet arra, hogy a felület kemény legyen, vagy a

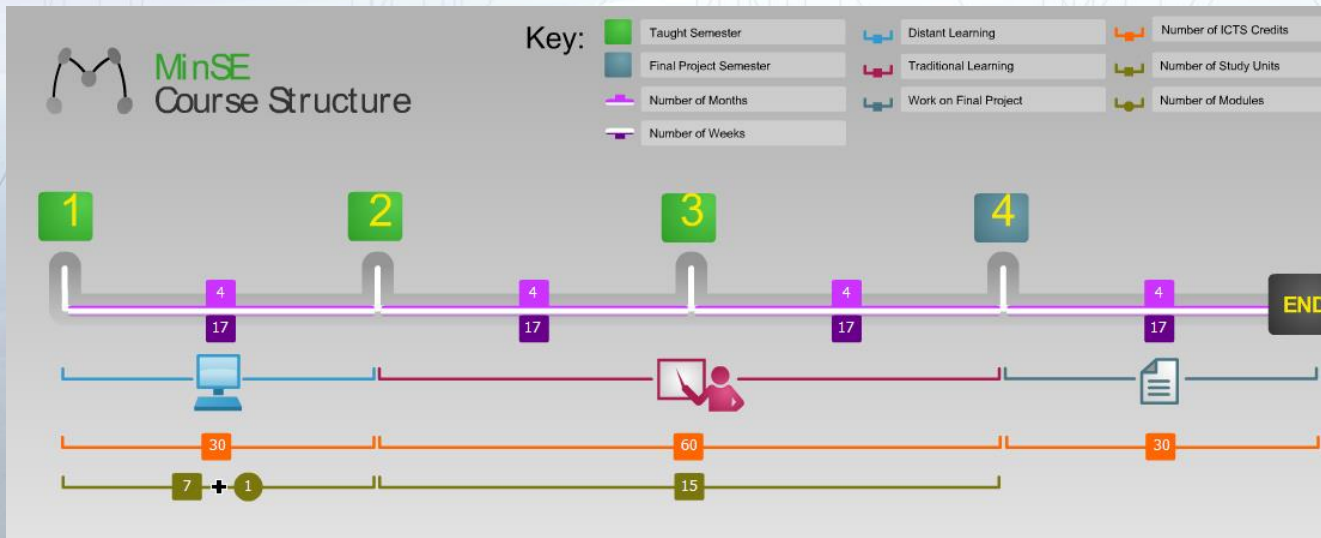
© Karsók-e Learning - 2011 North Hungarian Regional Distance Education Center, University of Miskolc, Hungary

Prof. Maurice Grech,  
 University of Malta  
 Co-ordinator of MinSE  
 project



## University-Industry partnership in MinSE

- Development of a Bologna-conform, accredited, full MSc programme: International Master in Heat Treatment and Surface Engineering
- 5 universities, 5 industrial partners + IFHTSE, (International Federation for Heat Treatment and Surface Engineering – world-wide professional organisation)



22 modules, 4 credits for each, offered also as self-standing professional development courses, delivered by international academic staff

# MinSE in Moodle Learning Management System



**MinSE**  
 International Master of Science in  
 Heat Treatment and Surface Engineering

5 universities 6 companies

The University of Miskolc  
 University of Cluj-Napoca  
 University of Pskov  
 University of Birmingham  
 University of Petro-Pharos

SPITSE  
 Bodycote  
 SE Limited  
 Micromaterials Ltd  
 M Sert Eng Ltd  
 Plasmaterm SA

**MinSE Demo Course** You are currently using guest access

MinSE ► Demo

**Activities**  
 Forums  
 Quizzes  
 Resources  
 SCORMs/AICCs

**Search Forums**  
   
 Advanced search ?

**Administration**

**Topic outline**

- 1 Metallic materials – Basics of crystallography - Ideal and real crystals – Imperfections in crystalline solids**
  - Ferrous Materials - Lesson 3
  - Entrance test
- 2 Theoretical basis of mechanical properties - Main characteristics of elastic and plastic deformation**
  - Material Selection - Lesson 3
  - Materials importance
- 3 Ferrous metallurgy – production processes, needs and new trends**

**Latest News**  
 (No news has been posted yet)

**Upcoming Events**  
 There are no upcoming events  
[Go to calendar...](#)

**Recent Activity**  
 Activity since Sunday, 10 October 2010, 12:30 PM

Demo accessible for guests: <http://edu.uni-miskolc.hu/minse>

## Synergy with recent EU-projects

- Open Educational Innovation and Incubation

Design of a sustainable organisational interface to improve university- market receptiveness and to improve incubation of educational innovation, e.g. Open Educational Resources, MOOCs



- Simola - Situated Mobile Language Learning

a mobile and web-based system for situated learners living abroad to record and share experiential learning about their host country's language and culture

- International Internship AGORA – aiming at

Improving flexibility and internationalisation of practical placement, internship programs

- for improving the employability of graduates,
- for strengthening relationship between Higher Education and economy





## Opportunities in ERASMUS+

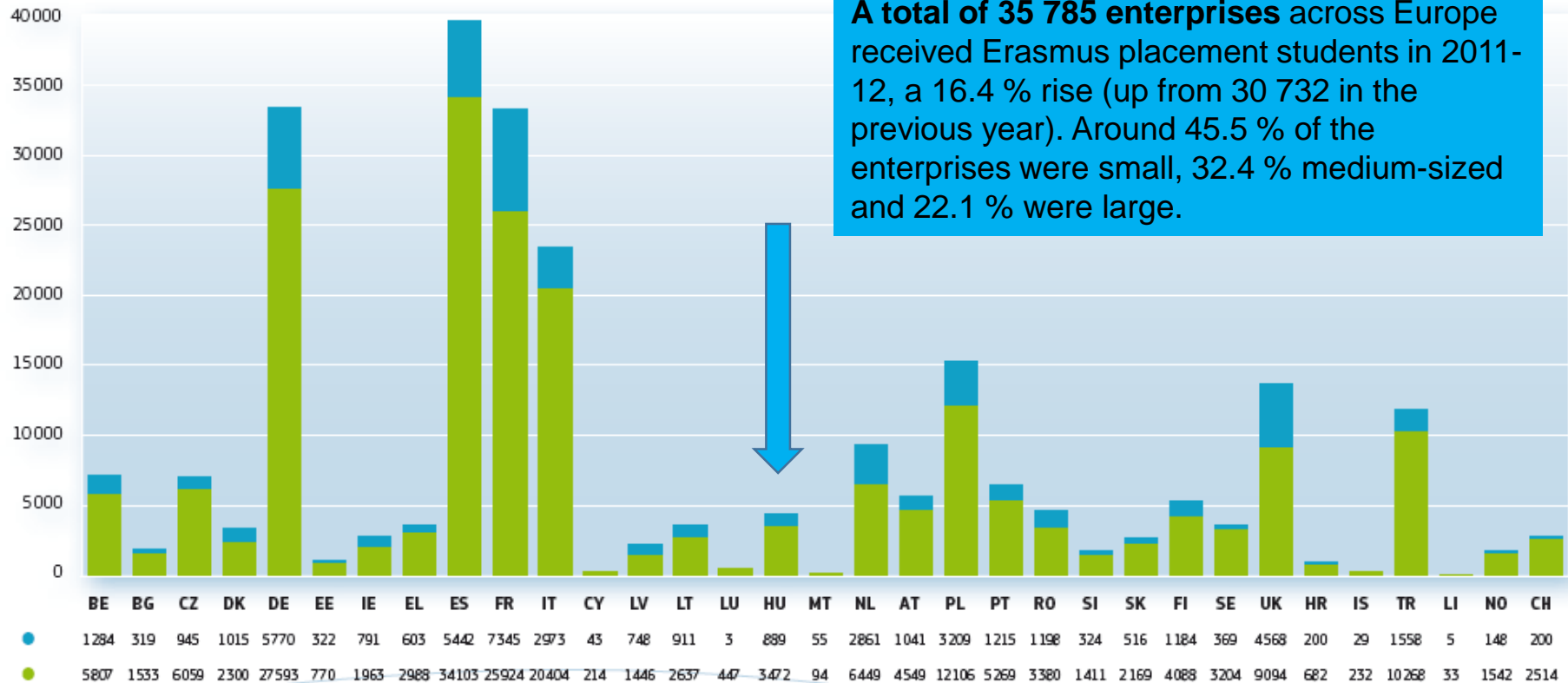
- 2014-2020 - investment in human capital - to support actions, cooperation and tools consistent with the objectives of the Europe 2020 Strategy.





# Work placement in ERASMUS (since 2007)

Distribution of outgoing students studying or doing work placements abroad in 2011-12

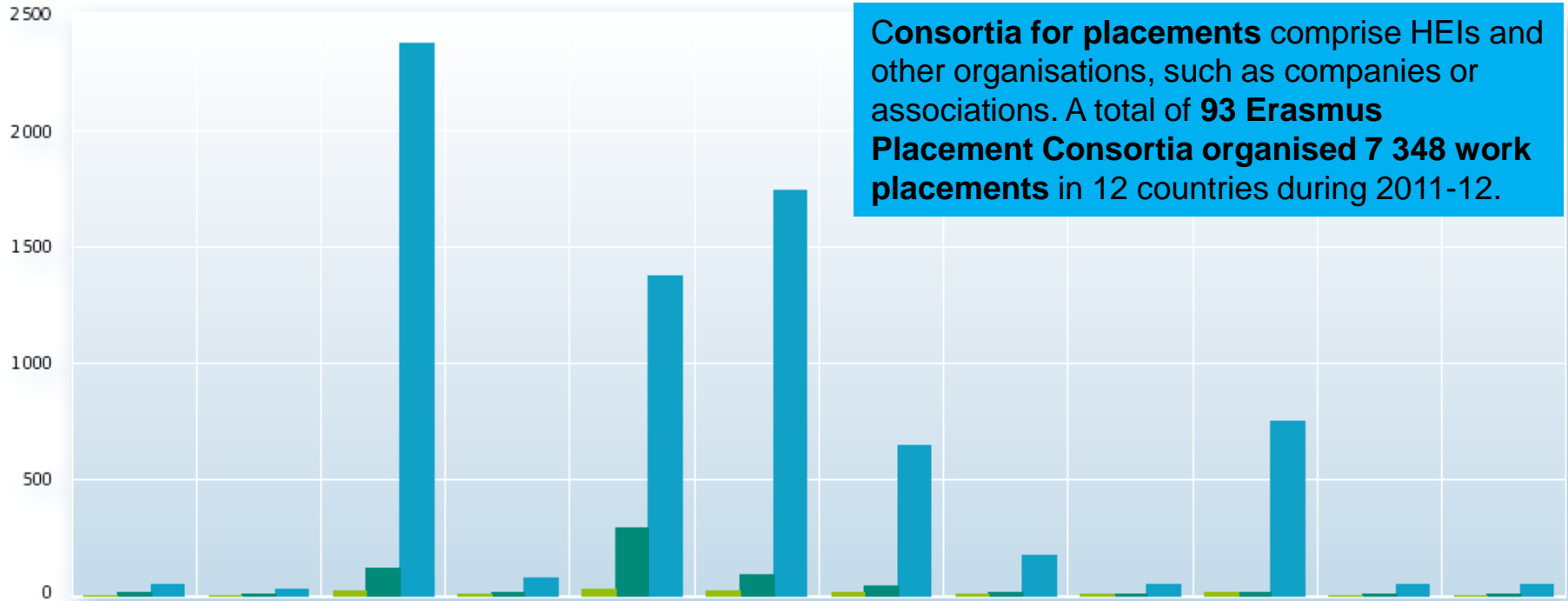


**A total of 35 785 enterprises** across Europe received Erasmus placement students in 2011-12, a 16.4 % rise (up from 30 732 in the previous year). Around 45.5 % of the enterprises were small, 32.4 % medium-sized and 22.1 % were large.



# New scheme for work placement exchange

Consortia for work placements per country in 2011-12



**Consortia for placements** comprise HEIs and other organisations, such as companies or associations. A total of **93 Erasmus Placement Consortia** organised **7 348 work placements** in 12 countries during 2011-12.

	BG	CZ	DE	EL	ES	FR	IT	AT	PL	PT	FI	TR
●	1	1	16	4	23	19	10	2	2	13	1	1
●	10	3	119	10	290	89	39	10	2	13	2	4
●	45	29	2373	75	1375	1745	644	174	49	745	46	48

- Number of consortia
- Number of Higher Education Institutions in consortia
- Number of placements organised

## E-Learning - Everyday practice, not just projects

- Applied materials science – final semester of engineering management BSc course

Group and individual tasks to find, systematise, analyse information on MS&T in Automotive sector



ERASMUS foreign students learning HT&SE in Miskolc  
Remix of learning materials developed in international projects

### E-Learning for ALL

- Part-time students
- Work placement
- Social networking

## Synergy with R&D project

# Material developments for the automotive industry: fundamental researches in metal forming, heat-treatment and welding

(TÁMOP-4.2.2.A-11/1/KONV-2012-0029)

Total amount of financial support: 473,3 MFt, cca 1,577,770 EUR)

Duration: 01.01.2013.– 31.12.2014.



<http://www.autotech.uni-miskolc.hu>



The project is supported by the European Union and co-financed by the European Social Fund.



## Expected outcomes of networking in TÁMOP project

### Networking of professionals for

- sharing experiences and resources,
- nucleating collaborative schemes
- enhancing accessibility to valuable information/resources

### by offering versatile support and services via a portal,

- as a gateway for provision of reliable information and
- as a virtual meeting point of a professional community to be involved

### Target groups - Potential users of the gateway portal

- Learners
- Teachers/educators
- Industry

## Elements of the Gateway portal

- Course finders
  - formal (degree courses in B, M, and PhD level) and
  - non-formal (short professional development courses)
- Recruitment of engineering students
- OER database – for informal learning - based on models studied and analysed
- Networking tools for the virtual community of academics
- Good practice examples

All activities will be supported by free, on-line tools, for providing sustainability and cost-effectiveness

# Draft design of the Gateway portal

Járműipari Felsőoktatási és Kutatási Együttműködés  
TÁMOP-4.1.1.C-12/1/KONV projekt - 07. alprojekt

Együttesen a  
mérnökképzésről,  
közös  
dolgainkról



**Diplomás  
képzések**

- Hova, mire jelentkezhetsz (középiskolásoknak)
- BSc, MSc
- PHD, szakmérnöki



**Tanfolyamok,  
továbbképzések**

- Középfokú műszaki képzések
- Mérnök továbbképzés
- Műszaki nyelv



**Minden tudás,  
ami elérhető**

Nyitott, online...

- kurzusok
- előadások
- tananyag elemek

## Conclusions

Should we teach MORE or BETTER?...

...or simply DIFFERENTLY?

- Changing needs and challenges
- Great potential in international networking
  - Networks of HEIs (SEFI, EDEN, EADTU)
  - Professional organisations, Industry
- Effective tools provided by ICT, Educational Technology
- Community of Practice



# Engineers of the future

In order to operate effectively, engineering graduates thus need to possess the following characteristics.

- They will be rational and pragmatic, interested in the practical steps necessary for a concept to become reality.
- They will want to solve problems and have strategies for being creative, innovative and overcoming difficulties by employing their knowledge in a flexible manner.
- They will be numerate and highly computer literate, and capable of attention to detail.
- They will be cost and value-conscious and aware of the social, cultural, environmental and wider professional responsibilities they should display.
- They will appreciate the international dimension to engineering, commerce and communication.
- When faced with an ethical issue, they will be able to formulate and operate within appropriate codes of conduct.
- They will be professional in their outlook, capable of team working, effective communicators, and able to exercise responsibility.'

Engineering Benchmark Statement: QAA, 2006 from „Teaching Engineering” by P.Goodhew

## Paradigm shift in education

- *Educational focus is shifting from **teacher-centered** to **student-centered**;*
- *Teaching approach is moving from **lecturing monotonously** to **facilitating students' autonomous and independent learning**;*
- *Learning style is shifting from **passive learning** to **active and collaborative learning***

# THANK YOU FOR YOUR ATTENTION.

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*Web:*

## COOPERATION BETWEEN HIGHER EDUCATION, RESEARCH INSTITUTES AND AUTOMOTIVE INDUSTRY

TÁMOP-4.1.1.C-12/1/KONV-2012-0002

## BASIC RESEARCH FOR THE DEVELOPMENT OF HYBRID AND ELECTRIC VEHICLES

TÁMOP-4.2.2.A-11/1/KONV-2012-0012

## "SMARTER TRANSPORT" - IT FOR CO-OPERATIVE TRANSPORT SYSTEM

TÁMOP-4.2.2.C-11/1/KONV-2012-0012

Nemzeti Fejlesztési Ügynökség  
[www.ujszechenyiterv.gov.hu](http://www.ujszechenyiterv.gov.hu)  
06 40 638 638



**HUNGARY'S RENEWAL**



The projects are supported by the European Union  
and co-financed by the European Social Fund.