SOCIÉTÉ EUROPÉENNE POUR LA FORMATION DES INGÉNIEURS
EUROPEAN SOCIETY FOR ENGINEERING EDUCATION
EUROPÄISCHE GESELLSCHAFT FÜR INGENIEURAUSBILDUNG

Looking ahead and taking actions for the five years to come

SEFI Annual Report 2014-2015

SEFI is the largest network of engineering education institutions and engineering stakeholders in Europe

"The passion for engineering education"

Published by SEFI aisbl, Brussels, Summer 2015

SEFI is the largest network of higher engineering education institutions (HEIs) and educators in Europe. Created in 1973, SEFI is an international non-profit organisation aiming to support, promote and improve European higher engineering education, enhancing the status of both engineering education and engineering in society.

SEFI is an international forum composed of higher engineering education institutions, academic staff and teachers, students, related associations and companies present in 48 countries. Through its membership and network, SEFI reaches approximately 160000 academics and 1000000 students. SEFI represents 4 decades of passion, dedication and high expertise in engineering education through actions undertaken according to its values: engagement and responsibility, respect of diversity and different cultures, institutional inclusiveness, multidisciplinary and openness, transparency, sustainability, creativity and professionalism. SEFI formulates ideas and positions on engineering education issues, influences engineering education in Europe, acts as a link between its members and European and worldwide bodies, contributes to the recruitment of good students whilst always promoting an international dimension in engineering curricula.

Our activities: Annual Conferences, Ad hoc seminars/workshops organised by our working groups and task forces, specific events and actions for the deans in engineering, scientific publications (incl. the European Journal of Engineering Education), European projects, Position papers, cooperation with other major European and international bodies such as the European Commission, the UNESCO, the Council of Europe or the OECD. The cooperation with partner and sister organizations in Europe and in the world is also one of our priorities.

For further information
SEFI aisbl
39, rue des Deux Eglises - 1000 Brussels (B)
Tel. + 32 2 5023609 - Fax: + 32 2 5029611
info@sefi.be - www.sefi.be

SEFI receives the support of its corporate partners

Table of contents

SEFI Annual Conference
12-15 September 2016
Tampere, Finland

TAMPERE UNIVERSITY OF TECHNOLOGY

Engineering Education on Top of the World: Industry University Cooperation

Subthemes include but are not limited to:

- University-Business cooperation
- Engineering Skills
- Sustainability and Engineering Education
- Quality Assurance and Accreditation
- Continuing Engineering Education and Lifelong Learning
- Open and Online Engineering Education
- Ethics in Engineering Education
- Curriculum Development
- Attractiveness of Engineering Education
- Physics and Engineering Education
- Engineering Education Research
- Gender and Diversity

Deadlines and instructions for authors available soon on

www.sefi2016.com

Contact: sefi2016@tut.fi

Message from the President

This has been a very positive year for our Society. We had an excellent conference in my home university, Birmingham. The theme was 'educating engineers for global competitiveness'. This continues to be an important theme for engineering educators as we continue to assess and where appropriate adopt ways of enhancing the skills of our graduates to meet the demands of society. The theme for the 2015 SEFI Conference at Orleans, France was Diversity. The engineering education community still faces challenges both in terms of ensuring that we attract students from all backgrounds and that appropriate teaching and learning tools are used to ensure the development of appropriate skills.

Plans for the SEFI 2016 conference in Tampere, Finland are well under way with a focus on industry academia cooperation.

In 2014 we held our inaugural SEFI debate in Brussels in the presence of Mrs Vassiliou, the European Commissioner for Education, Culture, Multilingualism and Youth. One of the actions arising out of that was for SEFI to offer some ideas and thoughts about how the Higher Engineering Education provision under Bologna has operated and how this could be improved. A Skills Task Force ws set up to develop a position for SEFI on engineering skills. A position paper on engineering skills is planned for publication in September 2015. Future debates are at the planning stage.

The annual European Convention of Engineering Deans moved to the South and to the beautiful city of Valencia. This was jointly organised with CESAER and the Universitat Politècnica de València (Technical University of Valencia). The format of the Convention enable the Deans' most important 'hot topics' to be identified and these will help inform both the work of the European Engineering Deans Council and the work of SEFI more generally.

The past year saw a number of administrative changes in the workings of SEFI. The Society's statutes have been adjusted and as a result the Administrative Council is now the Board of Directors and the Bureau now has the title of the Steering Committee. A significant change brought the European Engineering Deans Council under SEFI as one of its Councils. This should help strengthen its identity and also link deans more closely with SEFI and through them, their institutions.

Ensuring that the benefits of membership of SEFI are brought to the attention of institutions and companies is an important and ongoing task. There are opportunities to share effective practice, influence and develop policies, join potential project teams, contribute or lead working groups on 'hot topics' and contribute to publications, to name but a few of the benefits.

And finally, my two-year term as President concludes at the end of September and I hand over to Professor Martin Vigild from DTU. Much of the work of officers and the Board of Directors has been in the background, developing SEFI's future plans, which you can see in the SEFI strategy 2015-20 and the action plan. Professor Vigild and the Society will need our collective support to take this forward.

Professor Kamel Hawwash

University of Birmingham

President of SEFI

WEEF 2015 -World Engineering Education Forum « Engineering Education for a Resilient Society »[1] Florence 20-24 September

After a very successful WEEF 2014 organised in Dubai in December 2014, the 2015 edition of the WEEF will be organised in Florence, at the initiative of the University of Florence (Claudio Borri). The WEEF 2015 will welcome many events and international engineering conferences, the participating organizations being IFEES, SEFI/EEDC, ENAEE, EUCEET, GEDC, IGIP, IIDEA, IACEE, BEST and CoPI. The full programme and information about the different partners or invited keynote speakers can be found on www.weef2015.eu.

A lot of work was done in this context over the last 10 months due to the fact that SEFI agreed to organise, in cooperation with GEDC and CoPI, a special session on Resilience and Engineering Education to be held on Wed. 22 September, with presentations to be given by SEFI President Hawwash on Engineering education for resilience or Grand Challenges?, SEFI Vice President Moropoulou on The role of the engineer in protection and restoration of heritage and buildings, of SEFI BoD member, EEDC and GEDC, Prof. Tekinay, newly appointed as rector of the Isic University in Turkey on Urban Engineering as a Trans-disciplinary Area of Research and Graduate Studies, and a presentation of Prof. Tubino, Chair of CoPI. The session will be chaired by Dr. M. Murphy, SEFI BoD and Chair of EEDC. This plenary session will be followed in the afternoon by a round table on Attractiveness and Engineering Education, moderated by J. Beynon, Chair GEDC, with the following panelists: Profs. Hawwash, Moropoulou, Vigild, Murphy (all from SEFI), Kilpatrick, GEDC incoming Chair, M. Tubino and a representative from BEST.

Workshops and meetings of our joint SEFI-IFEES initiative "IIDEA" will be organised as well, under the leadership of Erik de Graaff (SEFI) and Jennifer Deboer (IFEES). WEEF will welcome the annual conferences of our partner organizations IFEES and IGIP, as well as activities of ENAEE, EUCEET, IACEE, BEST and SPEED, all organizations SEFI maintains relations with.

[1] *Climatic change adaptation, Natural disasters, Growing population and urbanization, Energy transition, Biotechnologies, Water crisis, Food crisis*

Message from the President-Elect*

It is an honour and a privilege to be elected by the SEFI General Assembly for President for 2015-2017. I am happy to pick up the responsibility, but also somewhat humble for the task ahead. SEFI is a strong community and it makes me confident to see the vigour and devotion amongst so many of our members.

Our community is the strongest and best represented body in the whole of Europe, which represents Engineering Education. Europe is diverse and there are many stakeholders in EE: University professors and educators, educational researchers, students, companies and industry, private and public institutions, and individuals with a devotion to Engineering Education. SEFI is the home for all and offers institutional, corporate, associate and individual memberships. SEFI also collaborates with other organisations in Europe and in the world who share the mission of SEFI to develop and improve Engineering Education and to strengthen the image of both Engineering Education and Engineering Education professionals

Under the 2013-2015 presidency of Prof. Kamel Hawwash of University of Birmingham , SEFI developed a clear vision for the development of the Society which was communicated in the SEFI 2015-2020 Strategy. New elements of the society's active calendar were initiated like the annual SEFI Debate which is held annually in Brussels in close juncture with the European Union. Also activities for Deans were consolidated with the SEFI Engineering Deans Council and the European Convention of Engineering Deans partnering with Conference of European Schools for Advanced Engineering Education and Research (CESAER).

During this time I served on the Steering Committee and I will continue the implementation of these ideas. On behalf of our Society I would like to express great thanks and gratitude to Prof. Hawwash for leading the society as an inspirational and visionary president that opened the fifth decade of our Society's existence.

I wish to contribute to continued flourishing and vivid development of SEFI. Our annual conferences are very important for both strengthening existing collaborative bonds between members, but also creating new ones. New members will typically meet SEFI for the first time at our conferences, which are very important venues for the growth and vitalization of SEFI. The back bone of SEFI is a made of the assembly of its National Correspondents and the network of Working Groups, Councils, Standing Committees and their Chairs. These organs must have the best possible conditions to work and thrive in order to be active and contributing elements of our Society. The role of the Board of Directors (previously the Administrative Council) is already clearly defined as the body responsible for the general policy. A more active role may be played by the individual directors as they accept to take charge of targeted projects. I look forward to two exciting years with focus on collaboration all around the Society in order to consolidate and develop SEFI for the sake of Engineering Education in Europe - and the rest of the world.

Professor Martin E. Vigild

The Technical University of Denmark

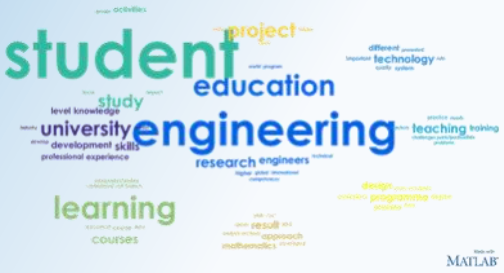
President of SEFI 2015-2017

The presidential mandate starts on October 1st 2015

2014-2015 Highlights

Educating Engineers for Global Competitiveness
SEFI Annual Conference 2014

210 delegates from 30 countries met in Birmingham, UK, on 15-19 September 2014, to discuss and share views and experiences on "Educating Engineers for Global Competitiveness". The SEFI Annual Conference 2014 was remarkable in many different aspects: the quality of the presentations, the interesting papers presented by colleagues from all over the globe, numerous productive workshops and challenging keynote presentations from Prof. Dr. Ramakrishna (National University of Singapore), Dr. Willey (Sydney University of Technology), Dr. Scurlock (Primary Engineer), Dr. Altman (University of Washington) and Prof. Roberts (University of Birmingham)



A detailed report of the Conference is available on www.sefi.be

SEFI F. Maffioli Award

The first recipient of the SEFI F. Maffioli Award was the Board of European Students of Technology—BEST. The Award is to commemorate 37 years of outstanding support and major contributions to the Society of the late Francesco Maffioli, reflecting his passion for cooperation with engineering students and ensuring they had a voice in the development of engineering education in the future.

The Award is given to individual students or student associations in recognition of their dedication to SEFI and/or engineering education in Europe and in World.

BEST was represented in Birmingham by its then President, Mathieu Vandenberghe. His acceptance speech stressed the importance of the collaboration of Students in Engineering Education as they should take also a key role in their own education and future.

SEFI Leonardo da Vinci Medallist 2014

Professor Dame Julia King is Vice Chancellor of Aston University and Patron of the Engineering Professors' Council.

Professor King received the award from Professor Kamel Hawwash of the University of Birmingham, current President of SEFI and a committee member of the Engineering Professors' Council. Commenting on the award, Professor Hawwash said "SEFI is delighted to award this prestigious medal to Professor Dame Julia King". In her wonderful acceptance speech, Professor Dame Julia King focused on the importance of Engineering Education and the various challenges, such as diversity and attractiveness that she has addressed and still addresses as Vice-Chancellor.

SEFI Fellowships 2014

The 2014 SEFI Fellowships Ceremony awarded this year Prof. Claudio Borri, former President of SEFI and founding President of IFEES (University of Florence, Italy), Prof. Urbano Dominguez, former Administrative Council member of SEFI and former chair of the Curriculum Development WG (University of Valladolid, Spain), and Prof David Radcliffe (Purdue University, USA) in recognition for their long lasting and active involvement in SEFI.

M. Fouger, Prof. Borri and Prof. Hawwash

Prof. de Graaff, Prof. Dominguez and Prof. Hawwash

Prof. Radcliffe, Prof. Froyen and Prof. Hawwash

EEDC workshop on Skills

Following the outcomes of the first SEFI debate, the European Engineering Deans Council (EEDC) organised a workshop on the topic "Engineering Graduate Attributes for the Future", supported by the American Society for Engineering Education (ASEE) that convened 20 participants for high quality discussions. Contributions from ASEE ("TUEE" report), the Royal Academy of Engineering (UK), BEST, TU Munich, and the Technical University of Denmark were presented and offered food for thought to the participants.

The outcomes of the discussions serve as base to the SEFI position paper on Skills (see p. 13)

SEFI General Assembly 2014

The Assembly took place on Friday 19th September 2014. It was attended by approximatively 50 members, present or represented.

The General Assembly (GA) saw the election of the SEFI President 2015-2017, in the person of **Prof. Martin Etchells Vigild**, Senior Vice-President and Dean of Undergraduate Studies and Student Affairs of the Technical University of Denmark.

7 members of the Administrative Council were elected or re-elected for a three-year mandate: Profs. **Aniko Kalman** (Budapest University of Technology), **Anne-Marie Jolly** (Polytech Orléans), **José Carlos Quadrado** (Instituto Superior de Engenharia do Porto), **Robin Clark** (Aston University), **Ludo Froyen** (KU Leuven), **Mike Murphy** (DIT) and Mr **Xavier Fouger** (Dassault Systemes). We would like to welcome all of them and look forward working with them in the coming years. The GA also appointed **Prof**. **Carlo Noé** (LIUC) as successor to **Prof. Angela Varadi** (University of Debrecen) for the office of Treasurer as from 2015.

The General Assembly also accepted a modification of membership fees for Institutions by the creation of two new categories, as well as the **SEFI Orientation Paper** which presents the priorities of the society for the upcoming years.

Changes in the status have also been presented, but as the quorum was not reached, an Extraodinary General Assembly (EGA) was called and organised on December 10th 2014, in Brussels. The EGA accepted the statutes modifications, the change in denomination of the Administrative Council and Bureau, now Board of Directors and Steering Committee, and confirmed the integration of the **EEDC-European Engineering Deans Council** as a Council within SEFI.

2014-2015 Highlights

"Diversity in engineering education: an opportunity to face the new trends of engineering "

The SEFI 2015 Annual Conference brought together a broad variety of Engineering Education actors from Europe and beyond. In total 285 participants from over 38 Countries met at Polytech Orléans in Orléans, France on June 29 to July 2, 2015.

More than 150 papers were presented in the course of 7 parallel sessions covering the theme of the conference *Diversity in engineering education: an opportunity to face the new trends of engineering*". Keynote presentations were given by Joëlle Bonnet from Mercedes Benz (FR), Teri Reed from Texas A&M University (US), Christophe Morace from ENSTA Bretagne (FR) and Alison Gourvès-Hayward from Telecom Bretagne (FR) , and Jette Egelund Holgaard from Aalborg University (DK) .

A full report is available on www.sefi.be

The Conference participants in front of the Château de la Villette, where was hosted the Gala Dinner.

SEFI Leonardo da Vinci Medalist 2015

The 2015 Leonardo Da Vinci Medal was awarded to **Mr. Charles Champion *President of Airbus Operations SAS and Executive Vice President Engineering.***
Mr Champion is a keen contributor to Engineering Education, part of the "Fly your Ideas" initiative, a UNESCO supported global competition for Students, founder of the *Chair for Eco-Design of Aircraft* but more noticeably the establishment with the Global Engineering Deans Council of the *GEDC Airbus Diversity Award*, which recognises people and project worldwide that have brought diversity and inclusion into the engineering student body.

SEFI-BEST Memorandum of Understanding

After years of collaboration and common initiatives and following the awarding of the SEFI F. Maffiolli Award in 2014, the Board of European students in Technology and SEFI have decided to formalise their relations by drafting a **Memorandum of Understanding.**

The formal signature between SEFI and BEST, took place during the closing ceremony of the conference and the document was signed by the Presidents of both organisation, K. Hawwash for SEFI and J. Clemente for BEST.

SEFI Fellowships 2015

The 2015 SEFI fellowships have been awarded to Dr. Anette Kolmos and Prof. Oliver Moravcik in recognition of their long lasting and active involvement in engineering education and in SEFI.

Dr. Anette Kolmos is UNESCO Chair for Problem-Based Learning in Engineering Science and Sustainability in Aalborg University, former President of SEFI (2009-2011), Founder of the SEFI working group on Engineering Education Research and of IIDEA—International Institute for the Development of Engineering Academics. She was also the recipient of the 2013 IFEES Global Award for Excellence in Engineering Education.

Prof. Oliver Moravcik is Vice-Rector of the Slovak University of Technology of Bratislava (STU) in charge of strategic projects and development, former member of the SEFI Board of Directors, Organiser of the 2010 SEFI-IGIP Annual Conference held in Trnava, Slovakia, former Director for Advanced technologies Research Institute of STU and former Dean in STU

SEFI GENERAL ASSEMBLY 2015

The General Assembly of SEFI met on Thursday 2 July 2015 in Orléans, with 58 members present or represented and observers. Among the decisions taken by the General Assembly, the **SEFI Action Plan for 2015-2017** has been accepted unanimously, setting the course of actions in line with the long term priorities of the SEFI 2015-2020 strategy. Changes in the **working groups** have also been presented with the appointment of new officers and the transformation of the **Task Force on Skills in Engineering** into a **Working Group**. The acting Chair of the Working Group on **Attractiveness**, **K. Schrey-Niemenmaa** (Metropolia University—FI) has been confirmed as Chair; the Chair of the Working Group on **Physics**, G. Langie (KU Leuven—BE), is replaced by **J. Tüli** (Tampere University of Applied Sciences—FI); the Working Group on **Continuing Engineering Education and Lifelong Learning** is placed under the leadership of Acting Chair **B. Norgaard** (Aalborg University). Following the integration of EEDC into SEFI, **Prof. Mike Murphy,** former President of EEDC has been confirmed as Chair of the SEFI-European Engineering Deans Council.

The renewal of the **Board of Directors** has seen the election of Prof. **Yolande Berbers** (KU Leuven), Prof. **Manfred Hampe** (4ING-TU Darmstadt), Prof. **John Mitchell** (U.C. London), Prof. **Katrina Nordström** (Aalto University), Prof. **Alain Rivière** (Supmeca), and Prof. **Sirin Tekinay** (Isik University) as well as the re-election of Prof. **Eskild Holm Nielsen** (Aalborg University). Mandates starts as of October 1st 2015 for 3 years.

The open **Vice-Presidency** for 2015-2018 has seen the election of **Prof. Luis Manuel Sanchez Ruiz** (Universitat Politecnica de Valencia). Prof. Sanchez Ruiz is currently Vice Dean and Head of International Relations at ETSID (School of Design Engineering) and has been an active member of the Board of Directors of SEFI since September 2012. Prof. Sanchez Ruiz was also the organiser of the European Convention for Engineering Deans 2015 (ECED 2015) in Valencia (see p. 12)

2014-2015 Highlights

European Convention for Engineering Deans 2015

The 7th edition of the ECED was held in Valencia (ES) on 26-27 March 2015. The ECED was jointly organised by SEFI, CESAER and the UPV and brought together around 90 Deans and Vice-Deans from all over Europe to discuss and exchange about "Engineering in a Global Context".

The participants of the 7th European convention for Engineering Deans

SEFI President Prof. Kamel Hawwash and the Rector of UPV Prof Francisco Mora Mas

The convention was organised on a series of plenary presentations given by **Prof. Francisco Michavila**, UP Madrid, Director UNESCO Chair on University Management and Policy, on "Challenges and Opportunities for EE in a Global World," **Prof. Peter Goodhew**, University of Liverpool (UK), on "What goes into Blended learning?", and **Prof. Robert Mudde**, TU Delft, on "Tomorrow's PhD Education & Research – What does quality in the global context mean?".

During plenary and in parallel group sessions, the attendees reflected on a series of pre-determined and hot topics such as *The New ERASMUS + programme: more exchanges of more bureaucracy?, How much importance should deans pay to learning of international skills and competences for engineers? Shifting the emphasis from what to learn to how to learn? Online education and E-learning, How to organise a PhD education together instead of programmes per faculty and university? The number of PhD students worldwide is increasing rapidly what will be the effect on researchers? …* Participants saluted the convention , and showed high appreciation rates for what they consider as a valuable event for deans in Europe.

The next ECED will be held in Spring 2016, in Athens, under the responsibility of Prof. Antonia Moropoulou from the National Technical University of Athens .

SEFI priority themes for the next five years (*)

- **Attractiveness**, *in terms of engineering education in general, in making a major contribution to the attractiveness of engineering to potential students at all levels, but also in terms of SEFI's attractiveness to both established and young educators and researchers;*
- **Education and Skills - Employability,** *in ensuring the best preparation of graduates for European and worldwide employers, whilst supporting the improvement of more coherent engineering education processes;*
- **Capacity building,** *in reshaping engineering education and contributing to the development of guidelines facilitating the* ***mobility*** *of graduates and students (****accreditation/quality assurance****) in Europe and in the world;*
- **Digital world** *- in taking into account the reality of a digital world where e-learning offers new possibilities and challenges, and where open and on-line learning and teaching may permanently change how engineering is taught and learned.*
- **Engineering education** *as a research field is developing strongly in Europe. This is vital to underpin the development of new educational practices and technologies to support the continued development of engineering education. There is a need to influence policies to ensure that this important research subject is adequately funded through EU programmes.*

(*) from the SEFI Orientation Paper approved by the 2014 General Assembly in Birmingham.

SEFI Position Paper on Developing Graduate Engineering Skills

Following the outcomes of the First SEFI Debate in April 2014, and enriched by the recommendation of the EEDC Workshop on Skills held in Birmingham in September 2014 (see p. 9), the SEFI Skills Taskforce on Engineering Skills, now a full working group, has drafted a position paper advocating SEFI recommendations in developing graduate engineering skills.
The position paper published in September 2015, under the lead of Dr. M. Murphy, Prof. K. Hawwash and Prof. M. Vigild, is available on www.sefi.be

A continuing discussion
SEFI invites comments and feedback on this Position Paper and a longer discussion paper which will be available at **www.sefi.be** from October.

Input will be reviewed by the SEFI Working Group on Engineering Skills, chaired by Professor Kamel Hawwash. Members of SEFI interested in joining the working group are invited to contact **info@sefi.be**.

Conference Proceedings Indexation

The 2014 and 2015 Annual Conferences Proceedings are available online on the SEFI website

Working with Elsevier through a US based consultant, SEFI has been able to secure the indexing of all SEFI Conference papers back to 2005 and going forward into the future. This work should be completed by September 2015 when all SEFI Conference papers will be indexed on Scopus.

IIDEA Workshops

IIDEA is a leadership training institute focused on establishing a global network of engineering faculty development programs to disseminate learning about the transformation of engineering education worldwide. IIDEA is hosted by IFEES and SEFI, located respectively at Marquette University, Milwaukee, WI (USA) and in Brussels, Belgium . The Institute has two Co-Directors (one co-Director in Europe, Erik de Graaff, PhD , one co-Director in the USA, Jennifer DeBoer, PhD) and an Advisory Board composed of distinguished members appointed by the Directors. The Institute founding co-directors were Lueny Morell, M. Sc and Anette Kolmos Ph.D.

Co-director Dr. Jennifer Deboer in Tsinghua July 2015

In July 2014 and in July 2015, IIDEA has organised workshops in Tsinghua University, Beijing, PRC that brought together more than 200 participants. In the last five years, Tsinghua University has hosted 5 workshops, bringing together more than 500 participants from over 80 universities who brought what they learned back to their own engineering teaching. In the past years, these workshops have also received the regular support of Mathworks, but also of HP and Quanser. In 2015 the workshop topics were Training for global/innovative competences and Authentic learning. To learn more about IIDEA please visit **www.iideainstitute.org**


The facilitators and local organisers, among which Lueny Morell, IIDEA co-founder and former co-director.


Participants of the workshop in action.

SEFI in Europe and in the World

We participated in or organised the following events [1]

September 2014
XIIth Triple Helix International Conference in TUSUR University, Tomsk
2014 SEFI Annual Conference and General Assembly, Birmingham
Kick off Symposium 3TU.CEE , Delft
EU Digital Action Day 2014, Brussels
QUEECA coordination/dissemination meeting, London

October 2014
Manuskills Project Meeting, Brussels
EU University Business Forum, Rome
SEFI Bureau Meeting, Brussels
QUEECA Management Board Meeting

November 2014
RISP - Rankings in Institutional Strategies and Processes: Impact or Illusion?, Brussels
ENAEE General Assembly and Administrative Council, Brussels
ReadyStemGo Project -First transnational meeting, Leuven
2nd European Engineers Day, Brussels
EPICES Project first meeting, Brussels
2014 Engineering Education Festa - "Engineering, A Bright Future, a Happy World", Korea
Engineering Leaders for Grand Challenges, Doha

December 2014
SEFI Bureau Meeting, Brussels
World Engineering Education Forum 2014 – WEEF 2014, Dubai
ECED Preparation Meeting with CESAER and UPV , Brussels
Workshop "Universities Engineering Education and Skills for Innovation, Entrepreneurship and Creativity", Athens
SEFI Administrative Council Meeting, Brussels
SEFI Extraordinary GA, Brussels
EEDC Extraordinary General Assembly , Brussels

January 2015
ICTIEE 2015, Bangalore
Preparatory visit by SEFI leaders in Orléans
QUEECA Forum, Porto
International Conference on Tranformation in Engineering Education, Hubli

February 2015
Cultural exchange organized by BEST in INSA, Lyon

March 2015
ECTNA Meeting, Brussels
6th European University-Business Cooperation, Brussels
7th European Convention for Engineering Deans, UPV Valencia
EPICES project Transnational Meeting, Valencia
SEFI Board of Directors Meeting, Valencia

April 2015
ReadySTEMGo Transnational meeting in TUHH, Hamburg
EUA Annual Conference, ANtwerp
7th International Material Education Symposium, Cambridge

May 2015
Meeting with WFEO, Paris

June 2015
EFMD General Assembly, Brussels
Politico event on CyberSecurity, Brussels
ASEE Annual Conference & Exposition 2015, Seattle
43rd SEFI Annual Conference & GA 2015, Orléans
QUEECA coordination meeting and dissemination event, Orléans

July 2015
IIDEA Workshop in Tsinghua University, Beijing
Position Paper Preparation Meeting, Dublin

1 We hereby apologies for any possible omission

Cooperation and Projects

Cooperation

IIDEA (International Institute for the Development of Engineering Academics)
The current co-directors are Dr. Jennifer DeBoer (Purdue University) for IFEES and Dr. Erik de Graaff (Aalborg University) for SEFI. Both secretariats are still based in USA (H. Hoyer for IFEES) and in Europe (F. Côme for SEFI), SEFI assuming most of the administrative and financial work and the maintenance of the website www.iideainstitute.org. Successful workshops were notably held in Tsinghua University in July 2014 and July 2015 and an open workshop took place in the framework of the SEFI 2014 Annual Conference in Birmingham, UK.

EEDC (European Engineering Deans Council)
In 2012, the EEDC was established as an independent organisation. However, following reflections about how best to position it for the future, the EEDC aisbl was dissolved last December and since January 2015, it has become a permanent SEFI Council. Prof. M. Murphy, former President of EEDC has been confirmed as Chair of the new entity that will also take an active role in the organisation of the future ECED.

ASEE (American Society for Engineering Education)
President Kamel Hawwash attended both the 2014 in Indianapolis, IN, and 2015 in Seattle, WA, ASEE conferences, with SEFI in charge of part of the ASEE 2014 International Forum. Talks on a couple of specific areas of collaboration on diversity and skills were held to be developed furtherover the next year. A new memorandum of understanding for a 5-year period is currently under development and should be signed in Fall 2015.

IFEES (International Federation of Engineering Education Societies)
Françoise Côme finishes her first mandate in IFEES Executive Committee next September, as well as IFEES VP for Europe. In accordance with the President she will candidate for a second mandate and is endorsed by Granta, Mathworks, Dassault Systems, the Turkish Deans, BEST and ASIBEI.
Collaboration has been reinforced this year with the preparation of the World Engineering Education Forum 2015 to be held 20-24 September 2015 in Florence, Italy.

GEDC (Global Engineering Deans Council)
The next conference will be held in Adelaide, Australia in November with a possible representation of SEFI. A joint SEFI/EEDC-GEDC event is being prepared to take place during the WEEF 2015 in September in Florence, Italy.
GEDC Chair, John Beynon participated in the SEFI Annual Conference 2014 where a workshop on Engineering skills was held for deans. Reciprocally Françoise Côme attended the GEDC event during the WEEF 2014 in Dubai.

CESAER (Conference of European Schools for Advanced Engineering Education and Research)
Cooperation with CESAER has been enhanced in 2015 with the organisation of the 7th ECED and it will continue with the preparation of the 8th ECED to be held in Athens. SEFI representatives also took part in workshops organised by CESAER.

EUA (European University Association)
There continues to be good cooperation, fostered by regular contacts between SEFI and EUA HQ's. Prof. George Rutkowski, member of the Board of Directors, from Silesian University of Technology represented SEFI in the 2015 EUA Annual Conference in Antwerpen (16-17 April 2015).

BEST (Board of European Students in Technology)
Students are important stakeholders in Engineering Education, and BEST is like a natural partner for SEFI at many occasions, in projects, in conferences, in publications, etc. BEST is present at SEFI activities and vice versa. Prof. Anne-Marie Jolly has represented SEFI in various events and workshops. Prof. Moropoulou represented SEFI at the BEST GA in Chania last May and in Orléans, SEFI and BEST have signed a Memorandum of Understanding.

ENAEE (European Network for Accreditation of Engineering Education)
Françoise Côme is still member of the Administrative Council until end 2015 and discussions for her successor as from January 2016 are ongoing .

FEANI (European Federation of National Engineering Associations)
Permanent contacts are maintained between the HQ of FEANI and SEFI (D. Bochar and F. Côme). F. Côme also attended FEANI events throughout the year, and SEFI should be represented at the FEANI Annual Meeting in Lisbon at the beginning of October 2015.

WFEO (World Federation of Engineering Organisations)
Close contacts are maintained also with WFEO Executive Director (T. Youssef). For the first time, WFEO was represented at the 2015 SEFI Conference and President Kammel Hawwash and Françoise Côme should attend the WFEO Forum in Beirut in October 2015.

IGIP (International Society for Engineering Pedagogy)
Contacts with IGIP are regular and friendly, Françoise Côme was invited in Dubai for the 43rd IGIP International Conference on Engineering Pedagogy , organised in the context of WEEF 2014. In September 2015, SEFI President, President-elect and Françoise Côme are attending the IGIP conference to be held in Florence in September in the context of the WEEF 2015. A Memorandum of Understanding will be signed for two years on September 23 2015 between IGIP and SEFI.

IACEE (International Association for Continuing Engineering Education)
SEFI is following closely the developments of IACEE it contributed to create decades ago. Prof. Wim van Petegem will be involved in the organising committee of the 2016 IACEE conference in Porto.

Bologna Process
SEFI Vice-President A. Moropoulou represented SEFI and attended the Bologna Ministerial Conference in Yerevan in May. The Ministerial Communiqué can be found on www.sefi.be. A report can be found in the SEFI June newsletter.

Projects

QUEECA - Quality of Engineering Education in Central Asia: this is a project aiming to set up and start implementing a system of quality assurance (QA) of engineering education in Central Asia (CA) countries, Uzbekistan, Kazakhstan, Kirgizstan and Tajikistan. Projects events will also be taking place during the WEEF 2015 in Florence, and a Management meeting in Brussels on 28 September 2015.
The project is coordinated by the University of Florence.

Co-funded by the Erasmus+ Programme of the European Union

EPICES – European Platform for Innovation and Collaboration between Engineer Students
The purpose of EPICES is to develop a European collaboration on a distance project-based learning framework and method, based on already existing and still developing technical platforms, i.e. collaborative and engineering tools. A special focus will be made on teachers' role and students' coaching, from the analysis of what a coach should be in project based learning to training packages for teachers and development of assessment methods. The project has also been presented during ECED 2015, SEFI 2015 and will be presented at the WEEF 2015. *The project is coordinated by SUPMECA*

ReadySTEMgo – Early identification of STEM readiness and targeted academic interventions
The project aims to improve the retention rates of higher education STEM programs by focusing on the academic readiness of incoming STEM-students. It will identify among incoming STEM students those that are at high risk of dropout and may thus need additional support and we will support those students with the help of intervention programs in the early phase of their studies. To achieve the above goal three different objectives will be realized: identification of the key STEM skills (objective 1). And once these are characterized, existing diagnostic tests are selected and their predictive power will be gauged in order to identify with high validity the at-risk students in need of extra support (objective 2). Finally, it will investigate which intervention tools can support these at-risk students and we will measure the effectiveness of current remediation programs (objective 3). The project was also presented during SEFI2015. *The project is coordinated by KU Leuven*

We give our thanks to all the coordinating projects teams

Our Working Groups

Quality Assurance and Accreditation

The SEFI Working Group Quality Assurance and Accreditation has an important role in these moments of evolution of the standards on quality assurance realised as well by ENQA (ESG) than by ENAEE (EUR-ACE), as it allows members of SEFI to debate and give their position on those subjects.

The fact to have a norm specific to engineering is something really important and it is necessary that general agencies could find a way to take this point into account when they evaluate engineering education.

In fact, there are in many countries agencies for quality that are specific or not for engineering and those agencies use to adapt their criteria to European recommendations. Nevertheless, a few non European agencies, such as ABET, intervene now in our countries. A debate about the way they take transversal skills into account is very interesting. Because of the globalization of curricula and of the circulation of our engineering graduates, it is fundamental to better know each other and better know the operating way of all these agencies. The SEFI WG on accreditation and quality assurance is the place where we debate of these orientations and share information. This year, the WG was solicited by ENAEE to give opinion on the ENAEE new criteria.

Much work is still to be done with the introduction of quality assurance systems in countries where this does not exist yet. Of course, our WG cannot work alone because quality does not stand by itself, it is the translation of educational policies, of governance politicies: elements such as innovative pedagogies or sustainability in engineering education are points that are part of the criteria for accreditation and are key elements of quality assurance.

Anne-Marie Jolly
Polytech Orléans/CTI
Chair SEFI WG QAA

Gender and Diversity in Engineering Education

Due to the demographic change and the European discussion about a raising lack of experts in engineering the focus changed from "(more) women in engineering" into change of educational and professional cultures to be more open for several diverse target groups not being integrated in engineering today. These changes include new ways of teaching, learning and working to raise creativity and innovation. In this context SEFI and the working group Gender and Diversity raised its memberships from 14 (2008) to 61 (2015), coming from several European countries, but as well from Australia and US. The members meet regularly at the SEFI annual conferences at a workshop. The internal e-mail list makes it possible to communicate over the year and to change experience, research articles and appointments. One highlight was the SEFI Annual Conference 2015, "*Diversity in Engineering Education - An opportunity to face new trends in engineering*" in Orléans. We learned about diverse ways, methods and theory to integrate Gender and Diversity into engineering and engineering education. It was the first time, that SEFI highlighted Diversity as the main topic of a conference and defined Diversity from an engineering point of view. This perspective will now be transferred into a position statement on "engineering skills" and as well into a SEFI Diversity statement as a commitment for future strategical activities and for its members.

Research outcomes

Three special issues of the European Journal of Engineering Education (EJEE) regarding gender and diversity in engineering education were published so far (Volume 30/ 4 2005, Volume 31/ 1 2006, Volume 34/ 5 2009). For a next one the planning started in 2015. Today around 40 articles on these topics were published there, as well as more than 80 conference papers from SEFI Annual Conferences. The main focus of the articles is the relevance of Gender and Diversity in Engineering Education and experiences of cultural change in engineering education and professional practice.

The working group is proud that from the TOP ten downloaded articles of EJEE three are about gender and diversity: *I still wanna be an engineer! Women, education and the engineering profession* (Judith Gill, Rhona Sharp, Julie Mills, Suzanne Franzway), Vol. 33-4 2008. Access: 600; *Gender stereotypes among women engineering and technology students in the UK: lessons from career choice narratives* (Abigail Powell, Andrew Daintry, Barbara Bagilhole), Vol. 37-6 2012. Access: 581; *Motivational factors, gender and engineering education* (Anette Kolmos, Niels Mejlgaard, Sanne Haase, Jette Egelung Holgaard), Vol. 38-3 2013.

Access: 551.
And under the highest cited papers are as well the papers from Abigail Powell et al. and Anette Kolmos et al.. And additionally: Barnard, S., Hassan, T., Bagilhole, B., Daintry, A.: *„They're not girly girls: an exploration of quantitative and qualitative data on engineering and gender in higher education"* (2012); Beddoes, Kacey: "*Feminist methodologies and engineering education research"* (2013).

Our future

The working group addresses the following activities: Participation in the SEFI position statement "engineering skills"; Development of a SEFI Diversity statement; Preparation of a special issue on Diversity for the EJEE; Enhancement of gender- and diversity related Quality Management in Engineering Education; Development of gender and diversity tools for the next SEFI Annual Conference in Tampere, Finland. We are in touch with several programmes and projects along the question of Women (and Men) in Science (www.genderinscience.org), with the European Centre for Women and Technology (ECWT), a network of female engineers, working together with NSF and US universities. Results (including downloads): www.womenandtechnology.eu, with the Network Gender & STEM (www.genderandstem.com) and with the international project Gendered Innovations in Science, Health & Medicine, and Engineering (genderedinnovations.stanford.edu), which gives an evaluated overview on examples for successful integration of gender issues in research and teaching / learning.
Together with partners from ASEE and WFEO we start with communication, experience exchange and co-operation.

Susanne Ihsen
Technical University Münich
WG Chair GD

Kacey Beddoes
Oregon State University
WG Deputy Chair

Mathematics and Engineering Education

The working group on Mathematics in Engineering education intends to foster discussion and provide orientation and supportive material for the steady and balanced mathematical education of engineers in Europe. This ideas are in full co-ordinance with the most important goals of SEFI regarding engineering education in general. The MWG makes these aims specific and operable for the field of engineering mathematics education.

Aims of the Working Group include: to provide a forum for the exchange of views and ideas amongst those interested in engineering mathematics, to promote a fuller understanding of the role of mathematics in the engineering curriculum, and its relevance to industrial needs, to foster co-operation in the development of courses and support material, in collaboration with industry, to recognise and promote the role of mathematics in the continuing education of engineers.

Driving force of the working group activities is the international Steering committee that meets regularly on its annual meetings organized at the Czech Technical University, Prague, Czech republic. During these working meetings the plans for the future activities are discussed, updates of the group website are agreed and all relevant issues concerning activation of the working group and its main aims for the future work are traced. The main activities of the steering committee are the following: Organization of the working group bi-annual seminars, the next one - 18th MWG Seminar on Mathematics in Engineering Education will be held at the Chalmers University in Gothenburg, Sweden, in June 2016. The overarching theme of the seminar will be the concept of mathematical competencies, including in particular issues as: transition to higher education for traditional and adult learners, learning mathematics through project work, mathematical competencies in web-based learning scenarios, and using technology to improve mathematics education. Proceedings with presented papers are published electronically and on-line; Cooperation with the MWG national contact persons in European countries, whose role is to disseminate information about SEFI MWG activities to all interested party in their countries, and inquiry about what SEFI MWG could do to help them in these activities.

Daniela Velichova
Slovak University of Technology
Chair SEFI MWG

Sustainability in Engineering Education

The challenge of this WG has been to find place and create specific interest when comparing to other

communities e.g. related to the Engineering Education for Sustainability conference. The strategy for the new working group leader, which was appointed in 2014 aims to increase closer collaboration with other members of the curricula working group, as this joint venture can strengthen the perspectives of a SEFI WG for the Sustainability as it links up to the specific engineering education expertise offered in the SEFI community. As a start we have planned shared activities at the WEEF conference; A more active role and joint activities with the Aalborg Centre for Problem based Learning in Engineering Science and Sustainability under the auspices of UNESCO, (hereafter the Aalborg UNESCO Centre) to offer specific Engineering Education for Sustainability Activities and link to the Aalborg Centre Global Network.. For example we are planning webinars on Sustainability and Engineering education arranged by the SEFI working group together with the Aalborg UNESCO Centre; Workshops at SEFI Annual Conferences...

The plan for this working group for the upcoming year is to engage cross-institutional research through a series of webinars and to collect storylines of "key challenges" and "best practice" from the SEFI community.

Jette Hoolgaard
Aalborg University
Chair SEFI WG SEE

Ethics in Engineering Education

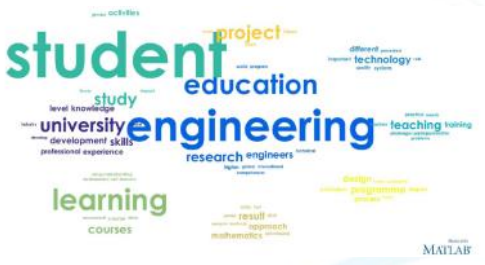
In January 2015, E. Alpay presented work titled "Creative Approaches for Student and Staff Engagement in Engineering Ethics" at the ExciTes Symposium (Excellence in Teaching, University of Surrey (UK)). This was followed by an application to the Leverhulme Trust, together with colleagues in English Language and Business Schools, for funding on work on cultural awareness and language in the classroom (outcome pending). The work will provide further scope for funded networking opportunities for WG members. There has also been involvement in a multidisciplinary project on pedagogic frailty, i.e. "a unifying concept that may help to integrate institutional efforts to enhance teaching within universities" (Kinchin, 2015), with specific consideration to teaching-research tensions, stress management and values versus content driven curricula. There is future scope here for wider (European) engagement. The work will be presented at the SEFI Annual Conference in 2016.

Preparations on a special themed issue in the EJEE on Formative Assessment Practices in Engineering Education will commence later this year. The topic is broad to cover aspects of independent learning and its support, and authentic (e.g. values-based) student motivation for learning that moves away from the marks-based culture. Professor David Shallcross, Director of the Engineering Learning Unit in the Melbourne School of Engineering and Editor-in-Chief of Education for Chemical Engineers, has kindly agreed to act as Guest Editor. As discussed on previous occasions, this WG may benefit from a broader remit through merger with another WG. However, it is important to maintain Engineering Ethics as a clear premise of any future grouping. Concrete proposals for this will be developed together with other WG Chairs over the coming months. In a related manner, the restructuring of this (and other WGs) may be an opportunity to consider wider specific discipline involvement (c.f. the WG in Mathematics, and (arguably) EER). For example, a model based on subject discipline leads (e.g. Chemical Engineering, Civil Engineering, etc…) may provide improved engagement with the community (and professional bodies). WGs may then be created on a short-term basis to address specific project needs. The organisation of conferences, rather than round WG topics, could then give consideration to current work on the taxonomy of EER, and thus promote broad cross-discipline contributions to each session.

Esat Alpay
University of Surrey
Chair SEFI WG on EEE

Engineering Education Research

At the 2014 Birmingham conference, the Working Group held a workshop and a Board meeting. There was also a strong EER track in the conference. The MathWorks conference paper analysis was a helpful way to illustrate our community.



The workshop focused on 'Capacity and Connectedness'. Four invited speakers (Brian Bowe from DIT in Ireland, Jose Manuel Nunes de Oliveira from Aveiro University in Portugal, Roger Penlington from Northumbria University in the UK and Cindy Altman from the University of Washington in the USA) all offered their thoughts about ways to build EER capacity across the globe and how, at the same time, to develop a better connected community. The 'lonely' journey of the EE Researcher was prevalent throughout, but the collective experiences of the speakers demonstrated the increasing evidence of community development whether that be within institutions, through national networks, establishing research centres or 'subject' communities (e.g. PBL or CDIO). The focus looking forward was very much considered to be around becoming a more inclusive and connected global community.

The Working Group Board explored the challenges the Working Group faced and the need to develop a higher profile. These have subsequently been taken to the SEFI Board of Directors whereby a new strategy for Working Groups and their engagement with members is being developed. The key issues for EER revolve around networking, visibility, communication, developing the quality of EER in Europe and finding opportunities (and funding) to enable us to work together. Within the countries and regions, activity continues to develop. The NEER group continues to prosper and met again in May. In the UK, the EER SIG has now become the UK and Ireland EER Network and it will hold its 3rd EER Symposium at the University of Cambridge in November 2015. Project and publication activity is evident from many countries across the continent. The Special Issue of EJEE on the state of EER in Europe is progressing. The abstracts received in response to the call were reviewed and a number of authors were invited to submit full papers. These papers are now being received and will be reviewed over the coming months to allow the Special Issue to be completed by later in 2015.

There was another strong EER track at the SEFI 2015 conference and both a Working Group Workshop and Board Meeting took place.

Robin Clark
Aston University
Chair SEFI WG EER

Curriculum Development

In the last five years the information technology and communications, coupled with the concept of global citizenship and responsible with their environment, have made the teaching of engineering and in general the concept of Engineering Education an innovative and dynamic element, more than ever.

SEFI is not indifferent to this change and from the curriculum development working group we try to share as much progress as the doubts that may arise when planning a suitable curriculum for our current and future engineering students. No matter Bachelor, Master, or PhD program.

Obviously, the basis on which all these advances are based, have a strong technological character, and thus the connection to the Working Group on Open and Online Engineering Education. At present we work on content lines, and the implementation of these contents, with the aim of this group to subdivide the first of these in three distinct topics:
(1) Connections with companies as generator of new curricula
(2) Curriculum development for Social Cooperation and Improvement
(3) Practical activities of new contents teaching in Engineering

One of the tasks being carried out this year and next year is the creation of a comprehensive survey of academics in engineering worldwide. Selecting a wide range of universities in the world and studying and comparing the subjects offered for the same area of Engineering. With this we can achieve common and uncommon that can be discussed in the various meetings held by the Group during the year (both within the SEFI conference, and at the level of skype or video broadcast).

SEFI Curriculum Development Working Group is an open list to all those interested in the development of different curricula in engineering, with a slight communication and voluntary participation.

Prof. Dr. Carlos Rioja del Rio
University of Cádiz
Chair SEFI WG CD

Physics and Engineering Education

The SEFI Working Group on Physics and Engineering Education (shortened as Physics Working Group, PWG) assembles physicists who teach physics to engineering students. They encounter similar problems irrespective of the country and the weight, the generality and the applicability of the course they are responsible for.

The group prepares on a regular basis the Physics Teaching in Engineering Education Conferences, (see www.sefiphysics.be). The next conference will be held in Zilina (Slovakia) from 18 to 19 May 2017. The members of the working group met this year in Zilina to prepare this conference.

Three of the members of the working group are working together in framework of the Erasmus+ Strategic Partnership readySTEMgo (see iiw.kuleuven.be/english/readystemgo/about) in collaboration with SEFI as the main networking partner. This project aims to improve the retention rates of higher education STEM programs by focusing on the academic readiness of incoming STEM-students. We will identify among incoming STEM students those that are at high risk of dropout and may thus need additional support and we will support those students with the help of intervention programs in the early phase of their studies. To achieve the above goal three different objectives will be realized: We will identify the key STEM skills. And once these are characterized, existing diagnostic tests are selected and their predictive power will be gauged in order to identify with high validity the at-risk students in need of extra support. Finally, we will investigate which intervention tools can support these at-risk students and we will measure the effectiveness of current remediation programs.

Prof. Greet Langie
KU Leuven
Chair SEFI WG PEE

Open and online Engineering Education

The WG aims to put her issue on the agenda to address current demands and trends that surface with the emerging importance of online learning.

News sources — A continuous activity will be the daily publication of relevant news items and resources on Open and Online engineering education issues curated by the WG using Scoop (www.scoop.it/t/learning4life) and Twitter (@pieter50twit).

Staff Development for online learning — An initiative was started to specifically organize a SEFI-partners consortium for the submission of a proposal in the framework of the Horizon 2020 program.

The argument is:
Online education is considered critical to the long-term strategy of Higher Education (HE) with consequences for the current professional development policy. While institutional development of online education and student enrollment in online learning has continued to increase, professional development opportunities for online educators have not been able to keep pace. In some cases, online educators are asked to teach and develop online courses with little or no prior training. Therefore improved professional development strategies are needed to facilitate and support faculty to cope with these demands

The aim of this initiative is to establish a firm group of participants that will closely work together and experiment with prior 'solutions' to develop a firm basis to ultimately submit a proposal for the Horizon 2020-program in April 2016. Progress has been slow, but a recent decision at the TU Delft to support this initiative enables the start of an experimental setting.

WG online presence — One of the issues discussed in the Work Groups meeting at the 2015 conference is the presence of the workgroups online. This should be improved and this WG will take the initiative to experiment with a 'format' that would allow also the other working groups to develop their own presence using the format.

SEFI Conference 2016 in Tampere — The WG has proposed to organize a half-day workshop on 'How to make a MOOC?'. There will be a cost of 100 euro's and it will include a 'SEFI-certificate'. This proposal is the initiative of the TU Delft in close cooperation with MIT. Details of the proposal will be delivered at the next BoD meeting.

WG other initiatives — Seeking to work together with other WG (like 'Curriculum development, Gender and Diversity).

Look for opportunities to organize intermediate 'events' (workshop, seminar, and other).

Prof. Pieter de Vries
TU Delft
Chair SEFI WG OOEE

Attractiveness of Engineering Education

The working group held a meeting during the annual conference in September 2014. As the chairmanship remained open, a new agenda was started to be prepared by the deputy chair.

The new agenda is based on a wide range of issues, but the future actions might not cover all of them. This gives flexibility to raise the issues, which are of sufficient interest that members not only want to discuss them, but more importantly which are the ones where they have an interest in working to a greater depth.

One important aim is to create an active network to help identify and discuss issues and from which members can find partners for potential project applications.

In the meeting during the annual conference in Orleans 2015 it was agreed that we will keep all the items listed below in our agenda: 1) What makes engineering education attractive? (ease of study, not much reading or difficultness, challenges; appreciation of the profession, high income, challenging career; possibilities to help to solve the most difficult challenges facing humanity; innovativeness of work; saving the world; possibilities of changing career); 2) What is happening before the university level? (the role of teaching; stem versus other subjects; gender attitudes, examples; attractiveness examples from real life); 3) What happens in the university? (curricula; teaching and learning; diversity; university as a community; restrictions of study, tuition fees); 4) How continuing engineering education could be attractive? (should an engineer work in an engineering field?; how to retain and enhance an individual's market value; the role of blended learning, MOOCs); 5) Your interest - please tell; 6) cooperation and networking with other WG's as many of these items have great overlaps.

We are open to add or delete issues to this list - hoping to develop a productive network around attractiveness.

Prof. Katriina Schrey-Niemenmaa
Metropolia University
Chair SEFI WG AEE

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From our corporate partners

USER STORY

Manchester Metropolitan University Students Vote Math Best Overall Course Following Adoption of MATLAB

2012 Teaching Award to mathematics for Best Overall Course at Manchester Metropolitan University. In 2011, mathematics was voted the Best Overall Course in the Faculty of Science and Engineering.

The Challenge

Attract and retain mathematics students and prepare them for careers upon graduation

The Solution

Integrate MATLAB across the mathematics curriculum to support learning based on real-world problem solving

The Results

- Enrollment quadrupled
- Student satisfaction and employability increased
- Teacher-student communication improved

With more than 34,000 students, Manchester Metropolitan University (MMU) is one of the UK's largest campus-based undergraduate universities, offering hundreds of degree programs in business, law, education, health, humanities, art, science, engineering, and other areas. Recently, students voted mathematics Best Overall Course at MMU.

The criteria for this award include high student satisfaction, outstanding teaching, and an innovative and engaging curriculum. Improvements in these areas are the result of several department-wide initiatives, including the integration of MATLAB® throughout the math curriculum.

"Since we adopted MATLAB, our enrollment has increased year after year, and math has become the best overall course at MMU," says Dr. Stephen Lynch, programme leader at MMU. "Upon graduation, our students' experience in solving real-world problems with MATLAB gives them an edge over graduates from other schools."

The Challenge

Following consecutive years of falling enrollment that saw the number of math students reduced by almost 40%, the MMU math department considered several options for attracting more students. "We needed to give students value for their money and enable them to develop knowledge and skills that would increase their employability," says Dr. Lynch.

In the past, there was little coordination among department members about which software students would use. As a result, students had to learn how to do the same basic tasks in several environments. "We saw that the time required to learn the new software would be better spent learning new concepts and techniques," says Dr. Lynch.

Students also had difficulties accessing the required software because the computer labs were heavily used outside scheduled class time.

The Solution

MMU mathematics department members coordinated and implemented the integration of MATLAB throughout the mathematics curriculum. The department provided each student with MATLAB and Simulink Student Version, enabling students to complete assignments and projects on their own computers.

In their first year, students take *Linear Algebra and Programming Skills*, in which they use MATLAB to add and subtract matrices, calculate their determinants, and transform them to reduced row echelon form. Students solve problems analytically using Symbolic Math Toolbox™ and learn programming principles and constructs using the MATLAB language.

Professors introduce new concepts in lectures using MATLAB, and students complete assignments in MATLAB during lab sessions.

Two required courses in the second year rely heavily on MATLAB. In the pure math course *Mathematical Methods*, students study eigenvalues, eigenvectors, and quadratic forms, using MATLAB to plot surfaces and visualize minima, maxima, saddle points, and other stationary points.

MathWorks®

"With its simple programming language, powerful graphics, and built-in functions, MATLAB enables mathematics to be brought to life and applied to real problems. At MMU, students use MATLAB to put theory into practice." —Dr. Stephen Lynch, Manchester Metropolitan University

For *Numerical Methods and Modeling*, students use MATLAB to solve differential equations using numerical methods, and work in groups to develop mathematical models that address real-world issues. In one project, they developed population growth models to study the effect of China's one-child policy, and then presented a final report, including MATLAB plots and results.

The most popular class for MMU math students is *Dynamical Simulation and Chaos*. This third-year class covers fractals, neuronal systems, and chaotic systems. Later in the course, the students learn how to use Simulink® to simulate many of the systems they modeled in MATLAB. The examination for the course takes place in a computer laboratory with access to MATLAB.

Students use MATLAB not only in required classes but also in several optional courses, where they develop sound and image processing algorithms, apply the Black-Scholes equation to financial data, and create lighting, shading, and reflection models that improve the realism of 3D rendered images.

The Results

Enrollment quadrupled. "The integration of MATLAB into the math curriculum helped reverse years of declining enrollment," says Dr. Norman Ellis, head of the Division of Mathematics and Computation. "Enrollment in math courses climbed from 45 students to 156, and classes based on MATLAB steadily became the most popular."

Student satisfaction and employability increased. "When students voted for mathematics over hundreds of other MMU courses, it reflected their satisfaction with our teaching and the curriculum, and showed that the decision to use MATLAB had paid off," says Dr. Lynch. "Further, the skills students develop with MATLAB will improve their job prospects and stay with them for the rest of their lives."

Teacher-student communication improved. "Working with students in the lab with MATLAB is a great way to get to know them—better than a lecture, small classes, and even one-on-one office meetings," says Dr. Lynch. "MATLAB enables an interactive, visual approach that gets students to open up, offer feedback, and ultimately gain a better understanding."

Industry

- Education

Application Areas

- Mathematical modeling
- Algorithm development
- Data analysis
- System design and simulation

Products Used

- MATLAB
- Simulink
- Symbolic Math Toolbox

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National Manufacturing Initiatives

New Economy needs Reshaping Engineer's Skills Profile.

Xavier Fouger—Dassault Systèmes, Senior Director Global Academia Programs

The recent years have seen many governments realizing that sustained employment or economic development requires industry at large to embrace new principles:

- User-centric value chains with reduced intermediate structures thanks to connectivity (Internet of Things – "IoT", Social Networks...), with increased distribution of the power to determine what is consumed and with the involvement of consumers, as crowds and as individuals, in the ideation, design and manufacturing of goods and services.

- Responsive, agile, distributed ("smart") production structures that are more automated and more digitized to enable global optimization of value creation, personalization, geographical distribution and consumer's reach.

National initiatives have mushroomed in support of the transitions of socio-technical practices, business models and economical and regulatory structures. One could name "Industrie 4.0" in Germany, "Manufacturing 2025" in China, "Manufacturing Renaissance" in the USA, "Make in India" or "Industry of the Future" in France.

The new economy resulting from those initiatives will be designed and operated by engineers. Many of them are yet to graduate and the challenge on engineering educators is considerable.

Personalized production techniques, distributed engineering and manufacturing, smart production facilities, globally dispersed stakeholders are some characteristics of the new industry that determine new competences in engineers. They are all enabled by the existence and use of a digital environment that provides a high fidelity representation of objects and their production system. Permanently connected to their physical avatars, those representations anticipate and drive the behavior of "things" but also continually digest information provided by actual devices to represent their real status in operation. These environments create the "digital twin" of the simplest gadgets to the most complex industrial structures. Because it is digital and reproduces reality as closely as possible, the digital twin provides an affordable and realistic context for educators seeking to make practices of the new economy an integral part of their students' learning experience.

The digital twin: realistic beyond virtual labs.

Virtual laboratory equipment is traditionally understood in two distinct manners. They can provide an electronic idealization of the behavior of the physical device or they enable remote operation of such device. In a recent exercise called the "Pune Experiment", Dassault Systemes validated the educational value of combining both approaches. An Arduino controlled desktop robot in Paris was controlled by its digital twin in Pune (India). Feed back was provided to the digital avatar over the internet and to the learner in India by a webcam displaying how the robot executed the instructions simulated virtually. Simulation in India was combining multiple aspects of the robot (kinematics, dynamics, electromechanical) into an integrated multi-physics simulation coupled with the actual parameters describing the physical device in France. In such configuration, learners can program their devices in a manner that reflects the limits of digital idealization. Assessing the existence and magnitude of discrepancies between digitally perfect models and the reality is an essential engineering skill in general; experiencing such correlation, with the device and its digital twin being distant, provides understanding of essential phenomena at work in an IoT context. The exercise, relying upon Dassault Systemes' latest technology –the 3DEXPERIENCE Platform- takes full benefit of a cloud-based architecture providing further opportunities to learn the role of virtualized platforms to operate networks of smart machines.

The digital twin: social beyond students exchanges.

Before being a "twin", the digital avatar is a "mother", the single source of truth of everything foreseeable about a product or a system, before its physical existence. The practice of defining and validating any device before making it is the essence of

Dr. Michael Grieves White Paper (2014): "Digital Twin: Manufacturing Excellence through Virtual Factory Replication", and founding article (2003): "Virtually Perfect: Driving Innovative and Lean Products through Product Lifecycle Management".

engineering. It combines in a shared computer representation all aspects of the form, the fit and the function of an object. The multi-disciplinary exercise of combining many categories of knowledge to create it is an essential skill which currently undergoes a profound change. The ease of sharing data across distance had already enabled technical collaboration. With the advent of cloud computing and social networks, software now also supports collective innovation in its social dimension. In a recurring annual activity led by ENIM (France), the Digital Farm Project (DFP), is an international, collaborative, multidisciplinary and digital capstone project. Gathering 16 universities in 7 countries in Latin America, Europe, Africa and Asia, this educational experience is a model for project-based learning. Students in their respective universities form a globally and culturally dispersed team and discover through practice, the attitudes and aptitudes required to engineer a farming practice supported by smart equipment to enable precision agriculture. The resulting robots are actually built by mechanical and mechatronics engineering students. Field testing is performed by agricultural engineering students who also participate in the engineering.

An essential learning outcome from this use of the digital twin is that it provides an ideal context to actually exercise the very practice of cross language, cross culture innovation as required from engineers who will experience the social paradigm underlying the new economy.

More change ahead

Beyond the examples above, many other new practices will gain momentum at a consequence of national manufacturing initiatives. Additive manufacturing, crowd based innovation, big-data dashboarding, digital factory, IoT and its disruptive business models,... Because they will have large impacts on engineering skills, Dassault Systemes works with industry to define them and with academia to bring them into the curriculum.

A complete documentation about both above examples can be found at: academy.3ds.com/lab/

Impact of the Maker Movement

NATIONAL INSTRUMENTS™ *Ray Hsu and Lance Johnson*

The maker movement is bringing engineering into the mainstream. Makers around the world are inspiring each other to create (or "make") smart gadgets, robotic gizmos, autonomous drones, and wearable devices. These innovations are no longer monopolized by multimillion dollar companies. Instead, makers work in home garages and collaborative workspaces with their peers. More importantly, they openly share their inventions online to inspire new innovations from other makers. Software development kits such as GNU Radio provide free tools surrounded by an active community that provides resources to anyone looking to develop wireless communication systems. This type of grass roots, "viral innovation" is disrupting the status quo. Is this the beginnings of the next industrial revolution?

The Homebrew Computing Club in the 1970s was founded by a small group of hobbyists building personal computers in their garages. They met regularly in Silicon Valley to share inventions and discuss new ideas. None of the members understood the historical implications of the meeting when two members of the club, Steve Jobs and Steve Wozniak, presented their new computer. It was the Apple I and it helped bring PCs to the masses and propel us into the information age.

The hobbyists of the 1970s were the same as modern day makers, but with one small difference. Over 195,000 people attended the two flagship Maker Fairs last year in San Francisco and New York, also known as the "Greatest Show and Tell on Earth". The internet is fueling a maker community orders of magnitude larger than what was possible in the 1970s. As the maker movement continues to grow and garner worldwide attention, it is important to assess the impact it will have on innovation, economic growth, and our future generations.

Consumer-Driven Innovation

The PC created a new generation of software developers who could innovate in the digital world without the limitations of the physical world. Through its inherent nature of virtually no marginal cost, software has become the great equalizer for innovation. Software provides an open canvas for creativity that empowers individuals to create highly valuable products with the ability to disrupt corporate -driven products and business models. At no other time in history has it been easier for an idea to originate in the imagination of a single individual and spread to a mass market.

Advances in 3D printing, low-cost microcontrollers, and the ubiquity of advanced sensors are enabling makers to bridge software with the physical world. Furthermore, the proliferation of mobile devices and cloud computing is helping makers contribute to the Internet of Things (IoT). IoT describes a world of interconnected devices that use sensors to interact with the people, environment, and other devices around them. This interconnection adds functionality and greater insight into an unlimited number of existing and new devices. By combining hardware and software, the maker movement will advance the IoT similar to the way that the open platform for mobile app creation has developed a new economy around smartphones. Examples such as an automated cat feeder, a slow cooker controlled via smartphone, and an umbrella that alerts you based on the local weather report showcase the lifestyle improvements and niche solution development that the IoT will provide.

Democratization of Entrepreneurship

The Pebble E-Paper Watch raises $10M. The LIFX smartphone-controlled LED bulb raises $1.3M. What do these products have in common? They both secured funding through Kickstarter, a crowdfunding website that is changing the game for entrepreneurs. Both products were created by the segment of makers who seek to commercialize their inventions. These "startup makers" iterate on prototypes with high-end tools at professional makerspaces such as TechShop and FabLab. There, engineers and artists collaborate to create products that not only use advanced technologies, but also have polished aesthetics. They then secure funding through crowd sourcing sites where success is based on the mass consumer valuation of the product, not the assessment of a few venture capitalists.

The maker movement is a catalyst to democratize entrepreneurship. For companies to remain competitive, they need to embrace the maker movement or leave themselves open for disruption. Executives at GE recently launched FirstBuild, a makerspace to engage students, entrepreneurs, and

makers to co-create appliances of the future. FirstBuild has already generated new projects such as instrumented refrigerators, quiet-close microwave doors, and a smart water pitcher that automatically refills when it is in the refrigerator. By embracing the ingenuity of its own employees and the public, GE is enabling a new process of product development and capturing the creative energy surrounding its products.

But the maker movement also has the potential to disrupt more than just novelty product markets and billion dollar businesses. Utilizing accessible technology and communication tools, the spread of this trend into the developing world, where innovation has traditionally been limited by access to such tools, has the potential to exponentially expand innovation and business development in those countries. Accessible technology has the power to shine a light on creative minds from around the globe and create inventors from all geographic and socio-economic backgrounds.

Education Transformation

"Tell me, I forget. Show me, I remember. Involve me, I understand" – Chinese Proverb.

As machines replace humans for manual and procedural work, education systems around the world need to shift focus from one-way lectures and rote memorization to collaborative, creative problem-solving environments. Learning by doing, iterating on ideas, and collaborating with peers are the hallmarks of the maker movement. This philosophy is exactly what we need to improve our education system. In fact, many parents have engaged in the maker movement with their kids because they know that the education system is not adequately preparing their children for the 21st century.

Education is ripe for transformation. PCs, the internet, and mobile devices have changed every aspect of our lives, except education. Adoption of technology in schools has not changed the lectures and multiple choice tests that make up the fundamental way we teach and assess our students. However, we have begun to see the first signs of a global trend in education where schools at all levels are transforming traditional classrooms and libraries into collaborative makerspaces. MIT has recently begun accepting maker portfolios in its admissions process, UC Berkeley has created a makerspace for students to collaborate, and non-profit organizations such as Maker Education Initiative are providing blueprints for grade schools looking to implement maker-like learning environments. And this is just in the formal education system. Online education portals such as Coursera and edX provide free classes so anyone with internet access has the ability to learn and build projects at home. Perhaps a cultural shift to the maker movement values will finally provide a significant transformation of our education system?

The Future Impact

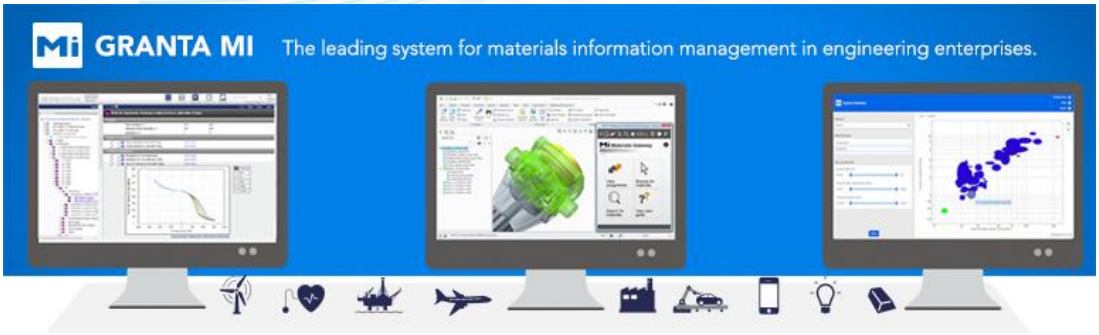
Humans are genetically wired to be makers. The maker movement is simply the result of bringing accessibility to powerful building and communication tools to the masses. It is a grass roots subculture that is enabling engineering innovation on a global scale. By democratizing the product development process, enabling these developments to get to market, and transforming the way that we educate the next round of innovators, we will usher in the next industrial revolution. The world is ours to make.

GRANTA
MATERIAL INTELLIGENCE

Educating future engineers and materials scientists to meet the 'Grand Challenges'

Granta Design's mission is to lead materials information technology – to advance materials engineering and education, and to enable better, greener, safer products.

Founded in 1994 as a spin-out from the University of Cambridge, Granta helps hundreds of engineering enterprises to manage information on the materials that are essential to their businesses. We help them develop and apply material intelligence, make better materials decisions, save time and money, and reduce risk as they optimize products.



Granta also provides educational software and supporting resources to thousands of university educators worldwide teaching the next generation of engineers, scientists, and industrial designers about materials, processes, and sustainability. We aim to provide a hub for communication, information and inspiration.

For more information about Granta visit www.grantadesign.com/education

Sharing knowledge with the materials community

*"Almost all the **'Grand Challenges'** identified as the essential technological and social advances for the next three decades have a material dimension. The part materials play in global and national economics and security is so important that governments list the materials they perceive as **'critical'** and seek to assure access and to identify substitutes or alternatives should their supply chain be disrupted."*

These are the words of Professor Mike Ashby, co-founder of Granta Design, in his address to the 2015 International Materials Education Symposia. He went on to stress the importance of education in meeting these 'Grand Challenges': *"The education of materials-literate engineers and of informed and innovative materials scientists is therefore essential for economic development and growth."*

The Materials Education Symposia that Granta helps coordinate have three main aims:

Materials Education SYMPOSIA

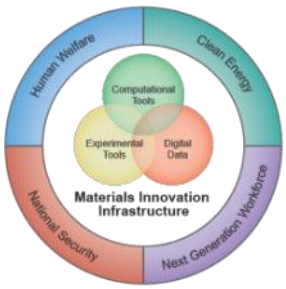
- share ideas, experiences, successes and failures;
- provoke productive discussion around these issues;
- expand the links between disciplines that form such a key feature of the materials community.

Over the past seven years these Symposia have brought together hundreds of people involved in teaching materials -related topics to undergraduates and helped build a vibrant international community.

Visit www.materials-education.com for more details.

North American Symposium

The 2015 North American Materials Education Symposium (NAMES) was hosted by The Ohio State University. It drew 60 educators from the US, Canada, and beyond. Modeling and simulation was a particular focus, with other themes including innovation in teaching and sustainable systems.



It was opened by Dr. Cyrus Wadia, Former Asst. Director, Clean Energy and Materials R&D at the White House Office of Science & Technology Policy. He spoke on the Materials Genome Initiative, a US Government policy that aims to get new materials to market twice as fast at half the cost. With a 2016 budget of $250M, an education component funds research in areas such as data handling and computation.

Feedback from participants was overwhelmingly positive, with leading author Prof. James Shackelford saying: "*I once again found the NAMES gathering to be an exceptional opportunity to share best practices and new ideas with fellow materials educators. Mike Ashby and his colleagues at Granta Design have provided an invaluable resource for our community.*"

International Symposium

The 2015 International Materials Education Symposium (IMES) in Cambridge involved more than 100 materials education professionals, from 20 countries, for two days of stimulating discussion. Granta's Dr. Claes Fredriksson discussed research into Materials Science and Engineering curricula at five universities in Europe and North America, which has led to proposed developments in CES EduPack™, Granta's world-leading teaching resource for materials in engineering, design and sustainability.

Asian Symposium

The inaugural Asian Materials Education Symposium (AMES) was hosted by the Department of Materials Science at the National University of Singapore in December 2014 with more than 100 delegates from 13 countries. An inspirational introductory talk by Prof. Fong Shih focused on the differences between the current "brown" economy and the desired "green" economy.

Granta Design and the Symposia Academic Advisory Committee would like to thank those that made these Symposia successful. In particular, our local hosts at: Cambridge, The Ohio State University, and National University of Singapore. We are also grateful for support from ASM International and MRS Singapore, and additional help from SEFI, FEMS, IFEES, and the Materials Division of ASEE.

Confirmed for 2016

7th NAMES at University of California, Berkeley	(17-18 March 2016)
8th IMES at University of Cambridge	(7-8 April 2016)
2nd AMES at National University of Singapore	(8-9 December 2016)

If materials-related education is of interest to you then we look forward to meeting you soon!

Our Publications

European Journal of Engineering Education

The **European Journal of Engineering Education (EJEE),** the Official Journal of SEFI, is published six times a year in print and electronic editions and provides an essential forum for dialogue between researchers and specialists in the field of engineering education, at European and worldwide levels.

The European Journal of Engineering Education is widely recognized as one of the leading journals in engineering education.

EJEE publishes Engineering Education papers from around the world. About halve of the submissions have a European first author. The acceptance rate of the European papers is higher than average, resulting in almost 60% accepted papers with a European first author.

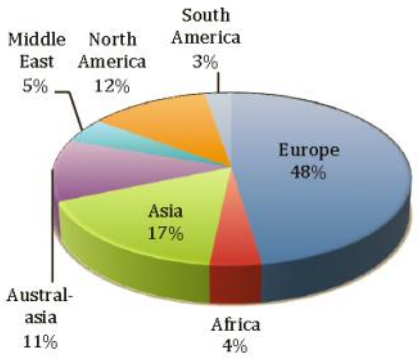
At present EJEE is still not listed in Thomson's ISI Web of Science. It is however possible to calculate the impact factor using data from the web of science. The estimated impact factor of EJEE for 2013 is: 0.223. The average over the past five years is 0.177, with a high of 0,212 in 2008 (EJEE Publishers report 2013).

The policy of the EJEE aims at serving the audience of engineering educators. Besides research papers we also publish case studies and reports from practice that may not be cited often by researchers, but that are useful to other practitioners. As a consequence the impact factor will be lower than if we would only publish research papers.

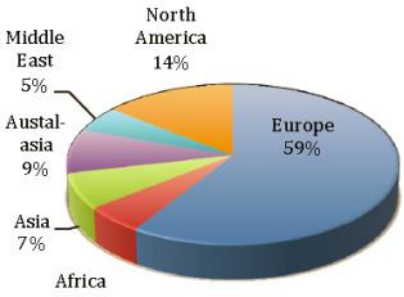
The number of downloads shows that some of the practice or opinion papers are significantly more popular than some highly cited research papers, like for instance the editorial in 2011.

EJEE works with the online submission and reviewing system Manuscript Central supported by the Taylor and Francis staff. The editorial office consists of Dr. Aida Guerra and Erik de Graaff as the editor in Chief. For each paper three tofive reviewers are invited. A minimum of three reviews is required in order to make a ruling.The editorial committee, composed of the Editor in Chief and the Associate Editors (Erik de Graaff—Aalborg University, Esat Alpay—University of Surrey, Jönte Bernhard — Linköping University, Anette Kolmos—Aalborg University, Bill Williams—Instituto Politecnico de Setubal) aims to consolidate the position of the Journal and to strengthen our relationship with the internationel engineering education community. We express our thanks to the numerous people who make eac issue of the EJEE possible, in particular our authors, our reviewers, the members of our international editorial board and the staff of Taylor&Francis.

Geographical distribution of submissions



Geographical distribution of accepted papers



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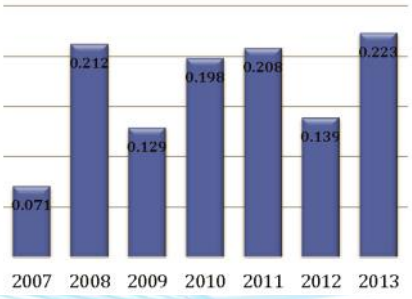

Erik de Graaff
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SOCIÉTÉ EUROPÉENNE POUR LA FORMATION DES INGÉNIEURS
EUROPEAN SOCIETY FOR ENGINEERING EDUCATION
EUROPÄISCHE GESELLSCHAFT FÜR INGENIEURAUSBILDUNG

39, rue des Deux Eglises
1000 Brussels – Belgium
Tel : + 32 2 502 36 09
info@sefi.be
www.sefi.be

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