



European Society for Engineering Education
Europäische Gesellschaft für Ingenieur-Ausbildung
Société Européenne pour la Formation des Ingénieurs

Building engineering education community in Europe for 45 years

SEFI Annual Report 2017-2018

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

"The passion for engineering education"

Published by SEFI aisbl, Brussels, September 2018



SEFI 2019 Annual Conference “Diversity in Engineering Education”

Budapest University of Technology and Economics – Hungary
16-18 September 2019

The SEFI Annual Conference is a scientific conference focused on Engineering Education and the biggest event of this type in Europe. They are a unique opportunity for professors, students, industry and professional organisations to exchange their views and to meet their peers and create a European network of contacts. The papers presented at the conference are listed in SCOPUS. Don't miss the opportunity to participate in this remarkable event!



European Convention for Engineering Deans University Leadership Dialog 2019

KU Leuven – Belgium
25-28 May 2019

Deans, directors, and heads of department at engineering education institutions meet annually to discuss the emerging topics of universities leadership and management. Join us for the 2019 edition in the very heart of Europe!

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Message from the President

It is an honour for me to write to you as President of SEFI, our wonderful community which is now celebrating its 45th anniversary, and to introduce our newest Annual Report. I write this message in the middle of July – a time of the year that I once remembered as being less busy, more relaxed, and with time to spend in greater abundance on writing and reflection. As I elbow time into my crowded schedule to write this, it appears to me that busyness is increasing, and that I have to work longer – deeper into the summer - and harder - more hours per day - in order to maintain equilibrium in my academic life. When I talk to colleagues, this appears to be generally true for them also. Perhaps, this is the personal equivalent of entropy in our modern world.

Therefore, in a time-poor society it is necessary to evaluate how we spend our time. Attending to our networks of partners and collaborations is essential, but this can become squeezed when we become busier. Consequently, we must actively reflect on our roles in engineering education and how better to perform those roles. SEFI, as the largest engineering education network in Europe, is a value network that can help us to be more effective in our respective engineering education roles: whether as teachers seeking to improve in the classroom, or as programme leaders seeking to understand effective pedagogical and curriculum change, or as deans seeking to discern key education trends, or companies seeking to reach a wider engineering education audience. Our SEFI community is the broadest network in Europe representing engineering education. Let us tap into that network. It has intrinsic value to us as its members, i.e., value to us because we are members of SEFI, and extrinsic value, i.e., external value attributed to us because we are SEFI members. It is important therefore to find the time to contribute to our SEFI community and to benefit from its value.

I believe that you will find much of interest and value in this Annual Report.

For example, we were delighted to join forces with 13 other university associations in order to respond to the initial proposal for the 9th Framework Programme for Research and Innovation (Horizon Europe), which is the successor of the Horizon 2020 programme.

SEFI participated in a Stakeholder Consultation in order to discuss and form a common agenda for an Engineers Europe Advisory Group (EEAG). This stakeholder meeting was organised by FEANI - federation of professional engineers that unites national engineering associations from 34 European Higher Education Area countries. Invited to the table were organisations that represent different aspects of engineering on the European level (education, accreditation, profession, research, employers, etc). The participating organisations recognised the importance of working together and speaking with 'one voice' on issues of mutual interest.

We were delighted, with the active support of our SEFI Working Group on Gender and Diversity in Engineering Education, to release our Position Paper on Gender and Diversity, and which is now available online.

At our 2017 Annual Conference in Terceira, the SEFI Fellowship Award was presented to Prof. Dr. Susanne Ihlen of TU Munich, and to Prof. Antonia Moropoulou of the National Technical University of Athens. You can read about their achievements in this Report.

In this Annual Report you can also find a link to Dr Ruth Graham's recently published report on 'The global state of the art in engineering education'. Our SEFI institutional members University College London, and TU Delft, are cited in this report as is Charles Sturt University (where Prof Euan Lindsay, SEFI individual member, is the Foundation Professor of Engineering).

SEFI is grateful for the support of our corporate partners in general: Dassault Systèmes, Granta Design, Mathworks, and National Instruments, and our events' sponsors in particular: Dassault Systèmes, Mathworks, Granta Design, National Instruments, Project Management Institute and Quanser. Particular thanks go also to our Working Group Chairs and to all members of our Board. Special thanks to those amongst our Board members who have accepted to lead specific lines of our Action Plan (2015-2020). I would also like personally to thank our Steering Committee for their invaluable advice and support over the last year. And of course, I cannot thank anyone without especially thanking our Secretary General, Mrs Françoise Côme for her tireless efforts on behalf of SEFI.



We also look forward to welcoming you to our 2018 Annual Conference in Copenhagen, along with our local host, the Technical University of Denmark (DTU). For this conference, we have re-structured the format to bring our Working Group sessions into the heart of the technical programme. We will also announce the winner of our SEFI Francesco Maffioli Award, and give you the opportunity to meet all the nominees for the Award. One of our keynote speakers is Prof Stephanie Farrell, ASEE President. We will host an interactive community dialogue with keynote speaker Dr Ruth Graham.

We live in an increasingly complicated world. The Irish poet William Butler Yeats once wrote in his poem The Second Coming: "Things fall apart; the centre cannot hold". Our challenges are many. Yet, as engineers and supporters of engineering education, we know that we can address these problems. We have many of the skills needed. SEFI too is part of the solution. This Annual Report illustrates the ability and impact of our Society. There is always more that we can do of course, if only we had more time. Let us try to find more time and succeed in doing more and showing that SEFI really matters for the individual and for Engineering Education in Europe.

Professor Mike Murphy
29th President of SEFI 2017 – 2019
Dublin Institute of Technology

“ Our challenges are many. Yet, as engineers and supporters of engineering education, we know that we can address these problems. This Annual Report illustrates the ability and impact of our Society.”

Professor Mike Murphy
President of SEFI

2017-2018 Highlights

SEFI 2017 Annual Conference in Azores



Our Annual Conference took place in Angra do Heroísmo on Terceira island, Azores, Portugal. It was organised by Instituto Superior de Engenharia do Porto with professors

Joao Rocha and **José Carlos Quadrado** leading the organizing committee.

The conference has had 283 registered participants from 37 different countries (12 non-European) The biggest number of participants came from Finland, the home country of the 2016 Annual Conference. The conference offered 5 plenary sessions, 11 workshops, 12 working group meetings and 32 sessions.

The keynote presentations reflected on various aspects of the conference topic “Education Excellence for Sustainability”. **Giovanni Azzone** (Politecnico di Milano) gave a presentation Educating for a changing World: New challenges for Engineering Schools, **Gary Bertoline**, Purdue Polytechnic presented Transforming Engineering Technology Education for the Digital Age, **Maria Knutson Wedel** (Chalmers University) spoke about the journey of integrating sustainable development in engineering education at Chalmers and finally **Dorte Rich Joergensen** (Atkins) spoke amongst other things about the UN Sustainable Goals.

Another highlight has been our University-Business Plenary Round Table, chaired by Mr. **Xavier Fouger**, Dassault Systemes and Member of the SEFI Board of Directors, with the participation of our corporate partners representatives: Granta Design, Mathworks, and National Instrument. Round table discussion amongst representatives of our partner organisations was chaired by **J.C. Quadrado**. Common issues such as member engagement were discussed.

Every year, we see an increase in the number of workshops and meetings organised for the SEFI annual conference participants. The workshops of European Projects PREFER and STELA (two projects of which SEFI is a partner) and working group workshops were organised too.

The conference proceedings are available at our [website](#).



New SEFI leadership: Vice-Presidents Luis Sanchez and Yolande Berbers and President Mike Murphy



SEFI 2017 group photo

The best conference paper of 2017 was: *Teaching sustainability to engineers: a systematic literature review* by **Fernanda Strozzi, Carlo Noe, Claudia Colicchia and Alessandro Creazza**. The best conference poster of 2017 was: *European Students' Perspective on Self-Directed Learning and the Role of the Professor* by **Celine Smekend, Maximilian Friedl, Hanija Bujas, Joao Camacho and Mustafa Berke Erdis**. Congratulations to all the winners! The award ceremony will take place at gala dinner at the 2018 SEFI Annual Conference in Copenhagen.

We would like to congratulate the organisers from ISEP on the enormous success of the 2017 Annual Conference and cordially thank Prof. Joao Rocha, Prof. José Carlos Quadrado and their organising committee for their efforts and smiles throughout this memorable event!

Leonardo Da Vinci medallist 2017



The Leonardo da Vinci medal is the highest distinction SEFI can bestow to award persons who have made an outstanding contribution of international significance to engineering education. In 2017, it was awarded to **Professor José Carlos Diogo Marques dos Santos**, former Rector of the University of Porto. The awardee has been the first Director of the 5-year Programme on “Informatics Engineering” of the Faculty of Engineering of University of Porto (1994 – 2001), was deeply involved in the design of two MSc programs at FEUP and in several revisions of the Programme in “Electrical Engineering and Computing”. After becoming Rector, he helped strategically reinforce the cooperation of the University of Porto with society and in particular with companies and other organisations, as well as increase strongly the level of internationalisation of the University, attracting students from more than 100 countries.

SEFI Fellows

The SEFI Fellowship Award recognises meritorious service to engineering education in Europe. The nominees are individual members of SEFI who have worked in the field of engineering education for at least five years. At the 2017 the title was awarded to:



Prof. Dr. Susanne Ihsen
 (Technical University of Munich)

Susanne is a professor for Gender Studies and a longstanding individual member of SEFI who has published numerous articles in the field of gender studies and diversity in engineering education, notably in the EJEE, for which she was

also guest editor for several EJEE issues. Furthermore, from 2008 to 2017, she has been the Chair of the SEFI Working Group on Gender and Diversity in Engineering Education, organised many workshops during the SEFI Annual conferences, and contributed to the preparation of the latest SEFI Diversity Statement.



Prof. Antonia Moropoulou
 (National Technical University of Athens)

Antonia has had many European and international responsibilities in the field of engineering education. She was the Vice-president of SEFI for the period of 2012-2015 and member of our Deans Council. Thanks to her, SEFI has enhanced

the cooperation with the European Commission and the European Parliament by successfully organising the first SEFI EU Debate (April 2014) at the Hellenic Representation office and another debate in December 2014 in Athens. In 2016, she was also deeply committed in the organisation of the SEFI debate organised at the European Parliament on “Labour Market Needs and Engineering Skills” (Brussels, European Parliament).

General Assembly 2017

The General Assembly 2017 met on 21 September, the last day of our annual conference in Terceira. The members approved the nomination of Prof. Yolande Berbers, Responsible of the Entrepreneurship and honours programme at the Faculty of Engineering at KU Leuven. The Assembly elected for a second three-year mandate in the Board of Directors **Prof. Robin Clark** (University of Warwick, UK), **Xavier Fouger** (Dassault Systemes, FR), **Dr. Habil. Aniko Kalman** (Budapest University of Technology and Economics, HU) as well as **Prof. Carlos Rioja del Rio** (University of Cadiz, SP). Prof. Gerhard Müller (Technical University of Munich, GER) and **Prof. Zbyněk Škvor** (Czech Technical University in Prague, CZ) were elected for a one-year mandate and **Marc Fry** (Granta Design, UK), Alexis François (SUPMECA, FR), and Prof. **Tinne de Laet** (KU Leuven) were elected for their first three-year mandate.

Assist. Prof. Kacey Beddoes (UMass Lowell, US) was appointed as Chair for the WG on Diversity in Engineering Education, **Dr Jan-Paul van Staaldouin** (TU Delft, NL) as Chair of the WG on Open and Online Education, and Assist. **Prof. Jordi Segalas** (Universitat Politècnica de Catalunya, SP) as chair of WG on Sustainability in Engineering Education. **Prof. Mike Murphy** assumed his position as SEFI President and Prof Martin Vigild was appointed as Chair of the SEFI European Council for Engineering Deans (EEDC). **Assoc. Prof. Kristina Edström** was introduced as the new Chief Editor of the European Journal of Engineering Education, taking this position in January 2018 from **Prof Erik de Graaf**, who successfully led the editorial team for many years.

Besides changes of SEFI officers, the attendees were presented with the President's report, the financial report, and the new SEFI website and database that was launched shortly before the conference.

European Convention for Engineering Deans 2018 – towards the Trondheim Trends



Participants of the ECED-ULD 2018

Deans, directors, and heads of department at engineering education institutions met in Trondheim at the 10th European Convention of Engineering Deans organised by SEFI, CESAER together with NTNU on 27-29 May 2018. This year's convention was dedicated to the topics of digitalisation and diversity. Flipping as a format was

introduced last year, however it really took off this year with high quality video contributions that were shared ahead of the meeting so the participants could prepare and discuss what they saw and give their thoughts and opinions at the sessions.

The first two sessions covered various aspects of digitalisation, digitisation, digital transformation and digital innovation. The skills gap between academics currently working in the institutions, how to change engineering curricula to reflect these changes, what are the practical steps towards a digital campus, the ethical questions behind the artificial intelligence and more. **Arlindo Oliveira**, President of School of Engineering, University of Lisbon (Portugal) and **Jonas Gallenkämper**, Secretary of Advisory Council for Eng. Edu, VDI – Association of German Engineers (Germany) presented their keynote speeches. In the panel discussion they were joined by **Xavier Fouger**, Senior Director, Dassault Systèmes (France), **Jan Gulliksen**, Vice President, KTH – Royal Institute of Technology (Sweden) at the end of the first session. The second session focussed on the more practical aspects of digitalisation of teaching, learning and research and featured **Hans-Ulrich Heiss**, Vice President, TU Berlin – Technical University of Berlin (Germany) and **Lars Kai Hansen**, Section Head in Dep. of Appl. Math & Comp. Sci., DTU – Technical University of Denmark as keynote speakers. In the panel discussion also **Alex Tarchini**, Director, Mathworks (Italy) and **Mike Murphy**, Director, DIT – Dublin Institute of Technology (Ireland) presented their views.

The second day, diversity became the main topic and starting from YouTube videos we could see how much the term diversity can actually mean and that we need to establish inclusive environment in order to benefit from the diversity. A very refreshing keynote speech by **Teri Reed**, Assistant Vice President, University of Cincinnati (USA) opened our minds to the topic, while a very practical keynote by **Doris Klee**, Vice Rector, RWTH Aachen (Germany) gave us tips on the practical steps towards this inclusive environment. **Greet Langie**, Vice Dean at Faculty of Engineering Technology, KU Leuven (Belgium) and **Mogens Rysholt Poulsen**, Dean at Faculty of Engineering & Science, Aalborg University (Denmark) were their partners in the panel discussion.

It is worth mentioning that besides very engaging discussions at the plenary and break-out sessions, the organisers prepared a very special social programme including a private organ concert in the Trondheim cathedral and a dinner with a view of the cathedral and jazz music, all set in the beautiful Nordic town of Trondheim surrounded by fjords and mountains.

The outcomes of the meeting will be collected in a final document, Trondheim Trends, which will be published before the SEFI Annual Conference 2018. The 2019 ECED will be organised by KU Leuven (BE) in May 2018.



Panel discussion: Digitalisation of teaching, learning and research



Keynote speaker Teri Reed (University of Cincinnati)

“ Important for success and acceptance of diversity is having the overrepresented (white middle-aged men) speak up on issue - it promotes acceptance and involvement. The underrepresented should be visible in the technical sessions in their field of expertise.”

Teri Reed

Assistant Vice President at University of Cincinnati

SEFI Debate 2017: 'Is engineering accreditation a force for quality or unnecessary oversight?'

SEFI has a tradition in organizing debates to tackle hot topics in Engineering Education. The 2017 debate was on the question: 'Is Engineering accreditation a force for quality or unnecessary oversight?'. The event took place at the premises of the European SchoolNet HQ in Brussels at November 30th and hosted some 30 participants as co-debaters.

Invited speakers were professor **Anne Marie Jolly**, chair of the SEFI Working Group on Accreditation and vice-President of CTI (the French Accreditation Agency) and Mr. **Denis McGrath**, vice-president from the European Network for Accreditation of Engineering Education (ENAE), the European organization for the authorization of accreditation to agencies in the field of Engineering (EUR-ACE label) and an information provider on accredited degree programs to employers, students and the general public.

Prof Jolly emphasized that accreditation has evolved from an authoritarian review act into an approach built on trust (respect for cultural diversity, taking into account a wide variety of educational laws and regulations and structures of institutions), and a focus on learning outcomes rather than syllabi. An important question is the relation between accreditation and innovation.

Mr. McGrath added to the conversation by defining the role of ENAE in the accreditation process. ENAE authorizes

accreditation and quality assurance agencies to award the EUR-ACE label to engineering degree programs.

In the lively debate that followed several important topics were discussed. It was clear that learning outcomes are rather difficult to measure and therefore to use in the decision-making process for accreditation. Also, the criterion of a job after school cannot be used to assess learning outcomes as Europe is very heterogeneous and jobs and salaries differ very much. Accreditation and the accreditation process should be a driver for both innovation and continuous improvement, whereas it in practice is sometimes more a barrier. There is a clear need for a better integration of innovation issues in the accreditation process. The general feeling was that there are many good practices in the area of accreditation, but there is a need for adequate communication about the process, and the tools are missing to fully profit from accreditation.

The conclusion was then that SEFI should play a more pro-active role to support the improvement of the process by cultivating the communication and exchange with partners as ENAE as its own networks of institutions.

Our thanks go to the moderator, John Mitchell, and our three rapporteurs P. de Vries, Y. Berbers and LM Sanchez-Ruiz.

Professors of Mathematics meet at SEFI seminar in Coimbra

On 26-29 June 2018, about 70 maths teachers from 15 European countries participated at the bi-annual 19th SEFI-MWG European Seminar on Mathematics in Engineering Education organised at the Institute of Engineering in Coimbra, Portugal.

The main topics of the seminar were:

- Putting the concept of mathematical competencies into practice
- Issues with, and good practice in, motivating students
- Assessing mathematical competencies and understanding.

The programme of the seminar was composed from keynote plenary lectures by invited speakers,

Edwige Godlewski (UPMC Paris, FR), **Jaime Carvalho e Silva** (University of Coimbra, PT), **Morten Brekke** (Agder University, NO) and about 40 short applied presentations and posters by mathematics educators.

Some of the most challenging parts of the programme were the spontaneous discussions among participants about the current issues – mathematical competencies, how to teach engineering students so that they will develop them and how to assess them. Participants shared their experience and best practices and came up with many new ideas and found colleagues to plan new projects and future cooperation.

"This regular event was again a very successful meeting of focused experts. We would like to thank the local organizers from ISEC, who also prepared a very interesting social programme – visit to the Science Museum and historical buildings of Coimbra University, one of the oldest universities in Europe. Proceedings of the 19th SEFI MWG Seminar will be available at the working group webpage.

Daniela Velichová,
SEFI MWG chair

Publications

European Engineering Deans Council: Munich Message

The [Munich Message](#) was published as an outcome of the 9th European Convention of Engineering Deans in Munich, which took place at TU Munich in April 2017. The Munich Message is a joint paper of SEFI and CESAER which comprises the key statements from a leadership dialogue amongst deans, directors and department heads of engineering institutions following the Valencia Vision and the London Agenda. It is focussed on three main issues and develops each one by a number of ideas arising at the meeting. The three issues are:

- I. Schools of Engineering face major challenges in teaching and research!
- II. Accreditation of study programs must respect its limits!
- III. Governance structures at universities present major challenges!

The second point was then used as a topic of discussion at our SEFI Debate 2017.



Inclusive environment as a birthplace of innovation

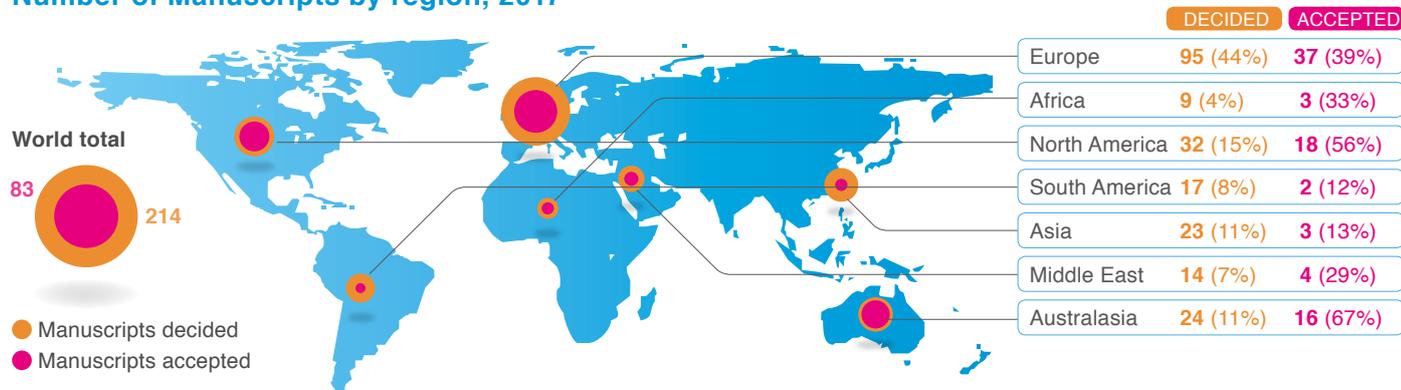
Position Paper on Diversity, Equality and Inclusiveness in Engineering Education

SEFI has published a new position paper on Diversity, Equality and Inclusion in Engineering Education that advocates and gives ideas for creating inclusive environment at engineering education institutions. The authors under the lead of SEFI Working Group on Diversity Chairperson, **Prof. Kacey Beddoes**, have outlined key steps towards an inclusive learning environment through giving appropriate instructions and supporting teamwork which does not exclude, and they bring attention to the subtle, implicit and unconscious biases. Read the complete [SEFI Position Paper](#).



European Journal of Engineering Education

Number of Manuscripts by region, 2017



A vibrant field

The interest in scholarly work on engineering education is growing in Europe and worldwide. As one of the leading journals, the European Journal of Engineering Education has experienced a substantial rise in submissions during the past few years. There were 314 new manuscripts submitted during 2017, which is a doubling since 2014. While this is a fundamentally positive indicator for the journal and the field, the capacity of the review process did not fully keep up, and some manuscripts were delayed along the way from submission to decision. Also, a backlog of papers was accumulating, making the time from online publication to print about two years. To reduce this backlog, Editor-in-Chief Erik de Graaff decided to increase from 120 to 160 pages per issue, effective from January 2018. He also led the production of the extraordinary December 2017 issue with 943 pages, or 56 papers. Together, these forceful measures succeeded in reducing the external backlog to just over one year.

New editorial team

Serving as Editor-in-Chief for over a decade, **Erik de Graaff** has taken the journal to the leading position it has today. He describes this exciting development in the editorial of the December 2017 issue. We thank Erik de Graaff for his outstanding service to the journal and his invaluable support to the engineering education community.



On January 1, 2018, **Kristina Edström**, KTH Royal Institute of Technology, Sweden, took office as new Editor-in-Chief. In order to increase the editorial capacity to match the current needs of the journal, she appointed two Deputy Editors, **Jonte Bernhard**, Linköping University, Sweden (previously an Associate Editor) and **Maartje van den Bogaard**, TU Delft, The Netherlands. Associate Editors remain: **Esat Alpay**, University of Surrey, United Kingdom; **Anette**

Bernhard, Linköping University, Sweden (previously an Associate Editor) and **Maartje van den Bogaard**, TU Delft, The Netherlands. Associate Editors remain: **Esat Alpay**, University of Surrey, United Kingdom; **Anette**

Kolmos, Aalborg University, Denmark; **Bill Williams**, Instituto Politécnico de Setúbal, Portugal.

Reaching a healthy steady state

It is a key priority of the new editorial team to make the editorial process effective and transparent, from the first submission of a manuscript to the final decision and, when this is positive, to online publication and print. When taking office, their first action was therefore to reduce the number of manuscripts delayed in the review process, to reach a steady state with acceptable lead times. On January 1, the journal had 285 manuscripts in the review pipeline, and during the first half of 2018 another 188 manuscripts were submitted (118 new and 70 revised). After a sustained effort by the full editorial team and a very large number of dedicated reviewers, a steady state has been reached by June 30 with about 50 manuscripts in review. The acceptance rate has been significantly reduced to a sustainable level that matches the available page count. As a consequence, only a select number of manuscripts can proceed to publication, meeting the highest criteria for usefulness outside the context where the work was made, as well as for novelty and scholarliness. This quality threshold will be reflected in the new Aims and Scope which will be published during the autumn 2018.

The editorial team wishes to thank first of all the reviewers, who so generously contribute to selecting and improving every manuscript. We thank the authors whose high calibre work is what makes the journal. Finally, we gratefully acknowledge invaluable support from the teams of SEFI and Taylor & Francis.

Dr Kristina Edström, Editor-in-Chief
Professor Jonte Bernhard, Deputy Editor
Dr Maartje van den Bogaard, Deputy Editor

Calendar

SEFI organised or participated in the following events in Europe and worldwide

October 2017

- **STELA Transnational Meeting** - Leuven, BE
- **GEDC Conference** - Niagara Falls, CAN
- **ENAAE Members Forum 2017** - Leuven, BE
- **EEBC Model** - Riga, LA

November 2017

- **WEEF 2017** - Kuala Lumpur, MYS
- **SEFI/ENAAE Workshop for Kazakh Rectors** - Brussels, BE
- **ENAAE General Assembly** - Brussels, BE
- **SEFI Internal Debate** - Brussels, BE

December 2017

- **SEFI Board meeting** - Brussels, BE
- **IREG Working Group on Engineering Rankings** - Moscow, RU
- **SEFI-FEANI-BEST-ENAAE coordination meeting** - Brussels, BE

January 2018

- **Transnational meeting EBCC model project** - Paris, FR
- **Meeting with WFEO** - Paris, FR
- **First EU Education Summit** - Brussels, BE
- **Future project on Attractiveness, meeting of the partners** - Brussels, BE

February 2018

- **SEFI Steering Committee meeting** - Dublin, IRL

March 2018

- **ERASMUS Salon 2** - Brussels
- **Meeting with GEDC, IFEEES and Dassault Systems** - Paris
- **WFEO 50th anniversary UNESCO Symposium** - Paris
- **PREFER Project meeting** - Brussels
- **ENAAE General Assembly** - Paris

April 2018

- **STELA Project Transnational Meeting** - Delft, NL
- **SEFI Board of Directors** - BME Budapest, HU

May 2018

- **IACEE World Conference 2018** - Monterrey, ME
- **Bologna Ministerial Conference** - Paris, FR
- **Integrity: A cornerstone value for HE & Research (Bologna Ministerial)** - FR
- **SEFI CESAER ECED-ULD 2018** - NTNU Trondheim, NO

June 2018

- **Les Alumni: Acteurs de l'Avenir** - CNAM Paris, Colloque CGE, FR
- **SEFI WG on Ethics meeting** - Brussels, BE
- **Engineers Europe kick-off meeting** - Brussels, BE
- **University associations and FP9** - Brussels, BE
- **ENAAE Administrative Council** - Dublin, BE
- **ASEE 2018 Annual Conference** - Salt Lake City, US
- **SEFI Mathematics WG Seminar** - Coimbra, PT

July 2018

- **IIDEA Workshop** - Tsinghua University, CN

Coming up in the autumn of 2018

- **46th SEFI Annual Conference** - Copenhagen, DK
- **WEEF and GEDC**, Albuquerque - New Mexico, U.S.



SEFI BOD meeting in Budapest - April 2018

SEFI EU Projects



STELA Project

www.stela-project.eu



The Erasmus+ project STELA (Successful Transition from secondary to higher Education using Learning Analytics) has entered its last year. In this final year the institutes involved, KU Leuven, TU Delft, TU Graz, Nottingham Trent University, are collaborating in large pilots that are offering learning dashboards with actionable feedback to first-year students. The LASSI dashboard offered feedback on learning and studying skills to more than 4.000 students distributed over 26 different programs at 9 faculties at KU Leuven. Currently, this dashboard is also being deployed at TU Delft.

In January 2018, the REX dashboard offering data-based feedback on grades after the first examination period, was launched at KU Leuven, reaching out to more than 7.500 students.

In March, in the Learning Analytics & Knowledge (LAK) Conference, the largest conference on Learning Analytics, the project partners organized a workshop on stakeholder involvement in learning analytics. In this workshop, they shared their experiences of transferring learning dashboards between European higher education institutes. Furthermore, KU Leuven has presented their case study results on a feedback dashboard for aspiring students that participated in the pre-university positioning test.

The STELA project is now disseminating its realizations in a follow-up project “Learning Analytics for Latin America (LALA)”, hereby challenging the transferability of the project outcomes outside Europe.

Project coordinator: KU Leuven

PREFER Project

www.preferproject.eu

The PREFER project (Professional Roles and Employability of Future EngineerRs), a European collaboration between KU Leuven, TU Delft and DIT, is getting up to speed. The developed Professional Roles Model consists of three distinct positions that reflect possible career paths for new graduated engineers: Product Leadership (focus on radical innovation), Operational Excellence (focus on process/product optimization), and Customer Intimacy (focus on tailored client solutions).

In February-March 2018, the Professional Roles Model has been validated by 188 representatives from industry: 94% of the respondents indicated that they recognized the model in their business. In order to map identifying competences to each of the three roles, a series of 12 in-company expert panels were organized in Belgium, The Netherlands, and Ireland (e.g., Engie, Siemens, ESB, Telenet, Materialise, ZF Windpower, Janssen Pharmaceutica). The output of these expert panels is currently analyzed and will be used as an input for a test tool that enables students to explore their preferences, strengths and weaknesses.



Together with researchers from DIT, the tool development has been initiated in collaboration with professionals of BDO. In a first part of the test tool, we will gauge student's preferred personal style. Through a number of fictional situations, students will be triggered to reflect about their preferred course of actions. After a validation stage, the first results will be available in the beginning of 2019.

The development of new, innovative curriculum elements to prepare engineering students on their future roles is

well on its way. The first elements were trialled in an MSc course at TU Delft last academic year. A second, bootcamp-style curriculum element aimed at students experiencing all three roles in one week is being prepared at the moment and will be piloted in Delft in the academic year 2018-2019.

Project coordinator: KU Leuven

EBCC Model Project

<https://www.sefi.be/activities/eu-projects/>

The two-year EBCC Model project (Educational Business and Companies Cooperation Model for a Creative European Engineering Education) started on 1 October 2017. Its main purpose is to strengthen the involvement of higher education institutions in the development of business innovation by engaging with local enterprises.

The main outcome of the project will be the creation of a sustainable partnership model between higher education institutions, local communities and industry.

Such a partnership model will contribute to teaching activities for engineering students who combine theory and practice in a context of real engineering applications.

Projects led by industry and/or the community will go through all stages of the partnership model developed from the adaptation of the study methods to the presentation of the prototypes of products created and the evaluation of the results of the studies. Students will experience the different stages of product development: design, simulation, analysis, manufacturing and testing, using rapid prototyping methods and tools.

Project Coordinator: Riga Technical University

Ongoing project applications

SEFI has joined three new project applications as a stakeholder:

Attracting diverse talents to the Engineering Professions of 2030, coordinated by ENSTA Bretagne - ERASMUS+ Strategic partnership (3 yrs) – project meeting organised in SEFI on 29-30 January to prepare the application for March.

Aus- und Weiterbildung der Lehrenden in MINT – Fächern zur individualisierung der Lernprozesse durch Digitalisierung, coordinated by University of Applied Sciences Bielefeld - ERASMUS+ Capacity building (3 yrs)

Holistic approach for Leading Equality in Research coordinated by European Women Rectors Association (EWORA) - H2020

Cooperation with other organisations

Engineers Europe Advisory Group

On 11 June 2018 SEFI along with other European Organizations in the field of engineering participated in a Stakeholder Consulting meeting organised by FEANI (federation of professional engineers that unites national engineering associations). The purpose of the Stakeholder Meeting was to discuss and form a common agenda for an Engineers Europe Advisory Group (EEAG). SEFI was represented by President, Prof. Mike Murphy, and Secretary General, Mrs Françoise Côme.

The meeting featured a brainstorming session on three key issues regarding the EEAG: (i) what topics should it address; (ii) why these topics; and (iii) how should these topics be addressed. The three areas for work identified after brainstorming and prioritization were: (a) Relations/greater engagement with industry (STEM,

etc.); (b) Branding of the profession/sector; and (c) Digital developments/digitalization.

The goal of the meeting was achieved allowing different organisations to speak on common issues, and that there was common will for a stronger engineers' voice at European level; and common ground for moving forward with EEAG. The Participants agreed to keep communicating, and next step is the meeting of 11 September 2018 with the participation of industry stakeholders and political forces.

Participating organisations were: BEST, CESAER, ECCE, EFCA, ENAEE, EU STEM PLATFORM, EYE, FEANI, SEFI, Hill+Knowlton, Schuman Associates, Mr. Peter VAN DER HIJDEN



Participants of the Engineers Europe Advisory Group meeting in Brussels. 11 June 2018

SEFI joins forces with 13 other university associations for the best Horizon Europe programme

At the beginning of 2018, SEFI joined the initiative of 13 university associations in order to respond to the initial proposal for Horizon Europe (Ninth Framework Programme for Research and Innovation), that is the successor of the Horizon 2020 programme for funding R&I.

The outline of our joint statement asking the European Parliament and the Council to support Horizon Europe is the following:

- Increase the total budget.
- Review the budget
- Put the realisation of the European Research Area at the centre of Horizon Europe across all pillars.
- Foresee better linkages between research, innovation and education.
- Include a human and societal reflection, as well as options for fundamental research, in all clusters and missions.

Discussions now continue about more specific changes to the proposed Horizon Europe programme. The participating organisations are trying to find a common voice to advocate for improvements in this funding programme that would be to the benefit of the European universities and higher education institutions.

Participating organisations are: LERU, EUA, EARMA, The Guild, EASSH, ECIU, Coimbra Group, CLUSTER, UNICA, CESAER, AURORA, IDEA League, YERUN and SEFI.

SEFI cooperates with these organisations

ENAAE (European Network for Accreditation of Engineering Education)



ENAAE is a close partner to SEFI and not only because SEFI its founding member. In 2017, Yolande Berbers (SEFI Vice President) was elected in the ENAAE Board, while Françoise Côme remains the SEFI representative at ENAAE General Assembly. SEFI and ENAAE Presidents and other representatives met on multiple occasions over the past year. SEFI helped with organisation of the ENAAE Forum held at KU Leuven last October, Denis Mc Grath came as a speaker to the SEFI debate in the end of November.

BEST (Board of European Students in Technology)



SEFI and BEST leaders met on several occasions during the year. BEST was also involved in the ECED 2017 where BEST representative, Alexia Spyridonidou, was invited as panellist for the session on accreditation. Klara Ferdova represented SEFI at the BEST Career days in Sofia.

ASEE (American Society for Engineering Education)



Luis Sanchez, SEFI Vice-President, attended the ASEE Conference in Salt Lake City in June, and the new ASEE President, Dr Stephanie Farrell will deliver a keynote at the SEFI 2018 Annual Conference in Copenhagen. The chair of our WG on Curriculum Development has visited the ASEE HQ and established a project cooperation with American colleagues earlier this year.

IFEES (International Federation of Engineering Education Societies)



SEFI maintains a long-standing cooperation with IFEES. SEFI was represented by Françoise Come at the WEEF 2017 in Kuala Lumpur and the SEFI candidate Prof Luis Sanchez was elected into the Executive Committee. Regular meetings are organised bringing together SEFI and IFEES leaders. SEFI is a founding member of IFEES.

IIDEA (International Institute for the Development of Engineering Academics)



Since the beginning of 2017, IFEES is fully responsible for the IIDEA Secretariat and web site. However, SEFI remains involved in IIDEA's activities, particularly in the context of the annual workshop organised with the University of Tsinghua. SEFI is a founding member of IIDEA.

CESAER (Conference of European Schools for Advanced Engineering Education and Research)



Cooperation with CESAER has continued with the organisation of the 10th ECED in Trondheim. CESAER should be associated to SEFI and NTNU in the publication of the Trondheim Trends, a paper that will present the outcomes of the event.

**SEFI also maintains relations with:
 FEANI, EUA, IGIP, GEDC, LACCEI, IACEE,
 UNESCO liaison committee for NGO, ABET,
 ASIBEI**

Working Groups

Gender and Diversity in Engineering Education (WGGD)

Integrating Gender and Diversity into SEFI

Engineering is empowering society in unprecedented ways. Engineering is innovative and can address Grand Challenges facing Europe and the world. Innovation is driven by personal experience and world outlook. Therefore, gender and diversity are core assets in innovation. In order to reach its full potential, the engineering education community should better include all parts of our societies. In particular, engineering education must actively engage and help promote the pursuit of engineering education and engineering careers with those interested and competent individuals who have been historically under-represented within engineering.

It is with this need that SEFI and the working group strongly believes that all must be provided with equality of opportunity to pursue and advance in engineering education and that no individual should experience marginalization or non-inclusiveness because of visible or invisible disparities. For example, among others, these disparities include gender, age, belief system, disability status, gender identity, gender expression, national origin, ethnicity, sexual orientation, and socio-economic status. SEFI is committed to increasing the participation, inclusion, and empowerment in all venues where engineering is taught, practiced, and supported. We consider the input of Gender and Diversity Research as relevant for our strategies, programmes and measures. Recommendations for stakeholders in university, accreditation bodies, industry, engineering organizations and political bodies were formulated in the SEFI position paper on gender and diversity in 2018.

Diversity in all dimensions (individual, organizational and societal), fuels innovation and the development of imaginative, holistic and enduring solutions to global challenges. This has been demonstrated in the SEFI Mission and the SEFI Diversity Statement since 2017.

Development of the Working Group

The working group Gender and Diversity in Engineering Education supports this organisational goal through international networking and experience exchange, through presentations and publications at SEFI Annual Conferences and the European Journal of Engineering Education (EJEE). We regularly have meetings at the SEFI Annual Conferences and continuously integrate

questions of gender and diversity into the conferences. We are in contact with other working groups and work in synergy to produce a modern understanding of gender and diversity in engineering education.

We now have an email list of 37 members (2017) from several European countries, as well from Australia and US. The members meet regularly at the SEFI annual conferences for experience exchange. We are happy to have increasing participation at the meetings during the annual conferences and a high interest of experience exchange face to face.

Since 2008 we have a homepage at the SEFI website (www.sefi.be). SEFI members and other interested people can join us and keep into contact.

We are in contact with several programmes and projects related to Gender and Diversity in Science, including:

- genSET (<http://www.genderinscience.org>)
- European Centre for Women and Technology (ECWT), a network of female engineers working together with NSF and US universities (www.womenandtechnology.eu)
- Gendered Innovations in Science, Health & Medicine, and Engineering (<http://genderedinnovations.stanford.edu>)
- Network Gender&STEM (<http://www.genderandstem.com/>)
- National Networks, such as the “National Pact for Women in STEM” (www.komm-mach-mint.de) and the “Nationales MINT-Forum” in Germany (www.nationalesmintforum.de)

Since the beginning of 2017 continuous reports about gender and diversity, with special thanks to the SEFI headquarters, are published in the SEFI newsletter.

2017 - 2018 Accomplishments

- 1. The SEFI Position Paper on Gender and Diversity was finished, approved, and posted online.**
- 2. The working group’s website was updated.**
- 3. A special issue of the European Journal of Engineering Education on Inclusive Learning Environments was published.**

Activities Planned for 2018 - 2019

For the Annual Conference 2018, we plan to have a workshop on methodological experience to integrate Gender and Diversity into Engineering Education. We would also like to plan new collaborations with the Engineering Education Research working group and the Open and Online Education working group in the coming year.

Furthermore, a paper for the European Journal of Engineering Education is in progress, which links to the

2010 SEFI/IGIP conference where we had the first summary about scientific outcomes on gender and diversity in engineering education and which will follow up these outcomes to a meta study, based on the publications in EJEE.

 **Assistant Prof. Kacey Beddoes**, Chair,
University of Massachusetts Lowell

 **Prof. Dr. Susanne Ihsen**, Deputy Chair,
Technical University of Munich

Engineering Education Research (EER)

In the last year, the SEFI's working group on Engineering Education Research (EER) further intensified its efforts to support the further development of the engineering education research field, and hereby engineering education as a whole, in Europe.

The most visible activities of the working group last year took place at the Annual SEFI conference in the Azores, Portugal. The working group organized a well-attended pre-conference workshop on the topic Publishing in an Engineering Education Research Journal. This success will be followed by a new workshop in Copenhagen, Key References in Engineering Education Research. The focus of this year's workshop is on broadening the participants' knowledge of important publications within the field, selected by the experts from our team. Additionally, the working group board is taking the lead as organisers of the Doctoral Symposium of this year's SEFI conference, bringing together PhD researchers and experts in the domain, hereby supporting the future of engineering education research.

Under the impulse of the new chair, Tinne De Laet (KU Leuven), the working group will intensify both formal and informal contacts to lay a solid foundation for future collaborations. To this end, this year's open meeting at the SEFI conference is used for short pitches of the working group members, kick-starting more intensive discussions and exploring common ground.

Finally, a sub-team of the working group board will work on the theme of membership, in order to clarify the role of board members and regular members. We are confident that this clarification can pave the way to a more intensive engineering education research community with broader participation.

The aim of the Working Group is to serve this community, which contributes to future enhancement of the education of engineers through research that combines scholarliness and usefulness.

 **Prof. dr. ir. Tinne De Laet**, Chair
KU Leuven

Continuing Engineering Education and Lifelong Learning (CEE & LLL)

At the SEFI Conference 2017 in the Azores, the CEE & LLL WG organized a workshop. Despite the lower number of participants, it turned out to be an interesting discussion about future expectations to CEE-methods and -approaches.

The active WG members met several times informally during the SEFI conference 2017 and among other things planned for a joint European paper presentation at the IACEE Conference 2018, resulting in the paper *"Engineering Students' expectations about skills and competences for jobs versus what is expected by*

companies and organizations. What is the need for continuing education after graduation (a European overview)?"

Together with the SEFI WG on Attractiveness we submitted a joint project application for a Strategic Partnership Erasmus+. The A-STEP project aims to develop new and innovative teaching approaches relevant to learners' values and adequate to teach a new set of skills and competencies needed for the future. The ultimate aim is to create an attractive and fascinating learning environment to encourage young people and adult learners to

engage in engineering studies and the profession as a whole. The questions A-STEP will give answers to:

- What are the future engineering skills and competencies required to enable a successful and sustainable European society, inspired by the Sustainable Development Goals (SDGs)?
- What are the intrinsic values and the drivers for young people, students and adult learners and how does this influence their future career choices or goals? Which identified skills and competencies align with the values of the potential talent pipeline?
- What kind of new and innovative teaching approaches would be suitable to teach these skills in a way which would attract and retain a diverse engineering student body?

We are now waiting for the result of our application, which should be published in July 2018.

Our WG is involved in another Erasmus+ Strategic Partnership – the ALTEF project (1st September 2017 – 31st August 2019). This project aims at experienced and skilled employees with a vocational background who need an academic education for their jobs. These professionals would obtain their academic qualification as well as acquire skills within company lines at the same time. Classical training frameworks (e.g. seminars) and educational programs (e.g. bachelor degrees) are either not tailored enough or lack the possibility to adapt apace to the changing needs of their participants. The main objective is to create a workplace integrated learning framework that can be implemented on a broad base for workers with a vocational background.



Dr Bente Norgard, Chair
Aalborg University

Quality and Accreditation of Engineering Education (QAA)

This year, the WG QAA has drafted a new position paper which will soon be launched.

The topic of the paper is similar to that of the internal SEFI debate held in Brussels in November 2017, which was based on the outcomes of the 2017 European Convention for SEFI Engineering Deans in Munich (i.e., The Munich Message). SEFI members engaged in an active discussion about the comparison of Program accreditation versus Institutional accreditation.

Currently, the main topic of the group discussion concerns our engineering education systems: all of us are looking for innovation of our accreditation practices, discussing with SEFI members from neighbouring countries is a good way to do so, which gives even more value to transnational accreditation!

Even if our education systems are different, this diversity provides stimulation and inspires pedagogical innovations, which should in turn not be limited by the accreditation process. The debate on QAA concerns the

fact that accreditation and particularly EAFGS launched by EUR-Ace is not convenient for all the engineering programs. Those frameworks, as well as the ones of CDIO or ABET, are attempts for a global contemplations on engineering: accreditation is not about specific details of curricula but about offering an outside perspective and understanding of engineering programs. The flexible framework created by the above agencies allows proposals to be made for continuous improvement of engineering programmes.

The last point to be considered is the simplification of accreditation procedures when the agency comes back for the periodic accreditation. It is a subject currently discussed by the Belgian and French agencies and also within ABET. This will also be a topic for the QAA group at the SEFI Annual Conference in Denmark alongside with the new trends in accreditation debated in UNESCO Geneva conference in February of this year.



Prof. Anne-Marie Jolly, Chair
Formerly University of Orleans

Attractiveness of Engineering Education

The working group has continued to build connections to other SEFI Working Groups, CDIO network and IACEE, as attractiveness is an issue covering the whole lifetime from pre-university, university and careers having several directions of professional development. Furthermore, different pedagogical models and quality issues play an important part in building attractiveness.

Our group continues identifying and discussing the new agenda: the issues that members are interested to discuss and the issues that they are willing to work on. The aim is to create an active network for such discussions that may result in project applications. Especially close cooperation has been established with the WG on Continuing Engineering Education. A concrete outcome of that cooperation was the joint presentation "From Earth to Heaven: Formats to Allow Adult Learners to Combine Working, Living And Learning, in the 49th EUCEN Conference June 2017 Mainz Germany. One more presentation has been planned for the WCCEE of the next year.

Our first EU-funded project on which we cooperate with the WG CEE&LLL took a more specific shape forward at a workshop during the SEFI 2017 Annual Conference in Azores. One of the partners managed to obtain extra funding for the preparation of the application, therefore a quality application could be developed. The core of the project is to find the future competencies of attractive engineering work in enterprises after the 4th industrial revolution and for universities, the ways to develop those competencies for students. This study needs to be done in European context, appreciating the different challenges in different parts of Europe. Additionally, the values of the new generation have to be carefully analysed.

The WG has decided to keep all the earlier listed issues on the agenda:

- What makes engineering education/profession attractive?
 - easiness, not much reading/difficulty, challenges
 - appreciation of the profession, high income
 - possibilities to solve the most difficult human challenges
 - save the world
 - possibilities of changing career
 - is there a conflict between the reality, values and reputation?
- What is happening before the university level?
 - the role of teaching
 - stem versus other subjects
 - gender attitudes
 - attractiveness examples from real life
- What happens in the university?
 - curricula
 - teaching and learning
 - diversity
 - university as a community
 - restrictions of study, tuition fees
- How continuing engineering education could be attractive?
 - should an engineer work in engineering field?
 - how to keep the market value

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



Prof. Katriina Schrey-Niemenmaa, Chair
Helsinki Metropolia University of Applied Sciences

Curriculum Development (CDWG)

The SEFI Curriculum Development Working Group tries to address the development and maintenance of a training plan according to the Engineering of the XXI Century for a correct performance in companies and entrepreneurship in general.

Last April, Dr. Carlos Rioja del Rio, from the University of Cádiz and member of the Board of Directors of SEFI (European Society for Engineering Education), visited the ASEE headquarters in 1818 N Street N.W. Suite 600, Washington DC, where he had meetings with Beville Watford (President), Norman I. Fortenberry (Executive Director) and Ashok Agrawal (Managing Director,

Professional Services). In these work meetings, particular topics were discussed about the relationship between SEFI and ASEE, in particular about Curriculum Development.

They also talked about the possibility of bringing together the ASEE leaders and the leaders of SEFI together with the STIMEY Officers of the European Commission for an open debate in Cádiz. The topic would be the approach of Science and Engineering to the Society. This debate should take place in 2019. Furthermore, collaborations have been agreed on the project level, specifically the HORIZON2020 STIMEY project, which is coordinated by

the University of Cádiz and brings together universities and companies from 5 countries.

A short visit was made to the MIT offices where meetings



Dr Carlos Rioja with Bevlee Watford, ASEE President, and Norman Fortenberry, ASEE Executive Director

were organised with Vijay M. S Kumar (Associate Dean of Digital Learning & Executive Director, Abdul Latif Jameel

World Education Laboratory), Eric Klopfer (Director of the MIT Scheller Teacher Education Program & Professor of Comparative Media Studies / Writing), Yoon Jeon Kim (Research Scientist at the Teaching Systems Lab), Aikaterini Bagiati (Research Scientist at Office of Open Learning-MIT), and Claudia Urrea (Associate Director, PK-12 Open Learning). During these days at MIT, joint research lines were established on knowledge, skills, and abilities to be acquired by engineering undergraduates. Collaboration between the STIMEY project and the MIT PK-12 project, and the possibility of exchange of researchers in the MIT Open Learning department.

These actions are part of the renewal that we are living in the working group. Together professors Fredrik Georgsson and Gareth Thomson, we are looking for new international projects, financing, means of publication, and specific outcomes in the field. We would also like to encourage the professionals interested in curriculum development to join our group.



Prof. Carlos Rioja del Rio, Chair
University of Cadiz

Mathematics and Engineering Education (MWG)



Annual meeting of SEFI-MWG Steering Committee members at Slovak University of Technology in Bratislava, December 2017.

Working Group on Mathematics is one of the groups focused on teaching a particular subject, Mathematics, which is an essential part of engineering study programs across all disciplines.

The aim of WG on Mathematics is to provide a forum for exchange of views and ideas amongst those interested in engineering mathematics and to promote information about new trends in teaching mathematics within engineering education at the [SEFI official webpage](#), and at the [MWG webpage](#).

One of the main activities of the Working group is organization of regular bi-annual SEFI-MWG European

Seminars on Mathematics in Engineering Education. This year, the seminar took place at the Coimbra University, Portugal, on June 26-29, 2018. You can read further about the seminar earlier in this annual report.

All the group activities are presented at the SEFI annual conferences, where meetings with the participants interested to join MWG are organized, as well as a regular session on Mathematics in Engineering Education. The WG members are also interested in cooperation with other SEFI working groups, and during the upcoming SEFI Annual Conference in Copenhagen, the WG chair will start discussions about possible coordination of activities with the WG on Physics, and potentially other interested groups.

Our WG has a steering committee consisting of 7 enthusiastic volunteers: Burkhard Alpers (Aalen University in Aalen, GER), Marie Demlová (Czech Technical University in Prague, CZ), Tommy Gustafsson (Chalmers University of Technology, SE), Duncan Lawson (Newman University in Birmingham, UK), Brita Olsson-Lehtonen (Helsinki, FI), and Paul Robinson, (Institute of Technology Tallaght, IRL). The group is coordinated by its chair, Daniela Velichová from Slovak University of Technology in Bratislava, SVK. The steering committee members regularly meet at annual working meetings organized at the STU in Bratislava at the end of each year. Over the course of two busy days, the committee members summarize all the work that has been done, analyse the feedback from their events and

evaluate the impact of the group's activities and plans the year ahead.

The group intends to foster discussion and provide orientation and supportive material for the steady and balanced mathematical education of engineers in

Europe. These aims are in full co-ordination with the most important goal of SEFI regarding engineering education in general.



Prof. Daniela Velichová, Chair
Slovak Technical University in Bratislava

Open and Online Education

Mobile, always online devices (such as our phones) have become ubiquitous in our daily lives. It is only natural that education will make use of such technology as well, or at least will explore the possibilities that such technology can offer for improving education. However, using new forms of technology in education will also require new forms of instruction. In addition, the increasing availability of learner data from the online technology offers new opportunities to support learners in their learning process, through advanced data analytics.

The working group Open and Online Education keeps track of developments and innovations in open and online technology and studies its use for teaching and learning in engineering education. In 2017-2018 the working group shifted its focus to include new and upcoming technologies, such as learning analytics, as well. For 2018-2019 the working group is particularly interested in innovative technologies that:

- Remove barriers and provide more students with access to engineering education;
- Innovate engineering education by making new educational formats possible; and
- Help advance the development of more personalized education by introducing evidence-based, data-driven educational practices and designs.

For 2017-2018 the working group has worked to put the topic of 'Open and Online Education' on the agenda, has kept up with current trends in the field, and provided a platform for those interested in the topic to connect and work together on research. In order to further explore this topic, the working group Open and Online Education will organize a workshop and a working group meeting at SEFI 2018 in Copenhagen. In addition, in order to create an online working group presence and networked resource base it was decided to use the SEFI website working group domain as the main channel for group communication. The working group uses social media in the form of a Twitter feed (@pieter50twit) to provide a continuous flow of information on the working group's topic.

The working group is always looking for new members who have a particular interest in open and online education, so if you would like to contribute to our Twitter newsfeed, or sign up as a working group member, we would like to hear from you – just send us an email!



Jan-Paul van Staalduinen, Chair
j.p.vanstaalduinen@tudelft.nl



Pieter de Vries, Vice Chair
Pieter.deVries@tudelft.nl
both from TU Delft

Physics and Engineering Education (PWG)

The SEFI Working Group on Physics and Engineering Education (shortened to Physics Working Group, PWG) assembles physicists who teach physics to engineering students, who often are at the beginning of their engineering studies. Physics teachers encounter similar problems irrespective of the country and the size, the generality and the applicability of the courses they are responsible for.

The main action of the PWG is to organize a conference "Physics Teaching in Engineering Education (PTEE)" for every two or three years. The next event will be in Delft the Netherlands, on May 23rd – 24th 2019, hosted by Hague University of Applied Sciences. More info will be at www.sefiphysics.be

Three of the members of the working group have worked together in framework of the Erasmus+ Strategic Partnership readySTEMgo (link: iiw.kuleuven.be/english/readystemgo/about) in collaboration with SEFI as the main networking partner. The partnership project reached its final goals at the end of 2017. The main goals were to improve retention rate of the first year STEM students by identifying key skills to successful STEM learning, finding instruments to recognize those students who are at the dropout risk and planning interventions to reduce the dropout risk.



Juho Tiili, Chair
Tampere University of Applied Sciences

Engineering Skills

The issue of just what skills engineering graduates should be equipped with to face the challenges that face society, continues to exercise the engineering education community. It is a given that graduates should be equipped with the technical skills they need in order to succeed in their chosen subject area and to meet requirements for accreditation in order to achieve professional recognition. This in turn allows them to be mobile through the various mutual recognition agreements, including the Washington Accord.

The SEFI Working Group on Engineering Skills (WKES) is currently reforming following a successful meeting at the SEFI 2017 conference. Its membership stretches as far East as Australiana and as far west as Columbia.

The SEFI WKES is building on the work done to date which formed the basis of the SEFI position paper 'Developing Graduate Skills', which was last updated in 2016. The purpose of the paper was to create a space for debate about just what skills graduates should have

and how they may be developed, taking into account the various stakeholders involved and the changing world we live in.

The WKES is working on updating our understanding of the current situation and to examine how we can translate this into specific skills and attributes to be developed. Once that is established, consideration of how the curriculum can be developed to reflect this and to identify learning methods that could be utilised to achieve this. It is also important that the development of such skills can be demonstrated.

The debate on engineering skills is ongoing. Join us if you wish to contribute to this important area of SEFI's work.



Prof. Kamel Hawwash, Chair,
k.i.m.hawwash@bham.ac.uk,
University of Birmingham

Ethics

The SEFI Working Group on Ethics is being reformed and starts with a new project: The SEFI Ethics Reader.

Engineers will face ethical questions in their professional careers. Engineering degree programmes should have prepared the graduates for moral decision making. Engineering ethics should thus have been part of the education of engineers at the universities. In some countries it is and in others not. European and national organisations of engineers recommend engineering ethics to become a mandatory subject of instruction. Only in a few countries like Ireland and the UK are ethical issues constitutive to engineering programmes, and their delivery is monitored in the accreditation of degree programmes.

The EUR-ACE Framework - Standards and Guidelines are vague and simply demands that engineers should be able to react on ethical issues. Not in all but in far too many engineering degree courses educational components devoted to engineering ethics are missing. Although it would be more than desirable that engineering ethics becomes a mandatory subject in engineering education, the de facto situation in most European countries does not allow to change the curricula appropriately in the immediate future.

Graduates from engineering degree courses are often left alone with ethical questions unless they start studying literature on ethics on their own. Here however, they might be lost in an abundant amount of literature on ethics that is neither meant for them nor would be of much use for them due to the philosophical jargon.

In this situation, a SEFI Ethics Reader consisting of short passages from philosophical core texts, augmented by comments and examples on the chosen texts might help. It is intended for self-study but might also be used for classes on Engineering Ethics at our institutions of higher education, or in workshops in further education for engineers practicing in the industry.

The discussion on the SEFI Ethics Reader started on a small scale with preliminary online meetings and will continue with a larger group during the SEFI 2017 Annual Conference in Copenhagen. All the interested SEFI members are invited to participate.



Manfred J. Hampe, Chair,
hampe@tu-darmstadt.de,
TU Darmstadt

Corporate Partners



The Changing DNA of Engineers in the Industry Renaissance

“The Industry Renaissance produces forces that deeply change fundamental social characteristics of an engineer and pose new challenges to their educators.”

Xavier Fouger

Senior Director Global Academia Programs, Dassault Systèmes

The current Industry Renaissance is a profound change made visible by national manufacturing initiatives (*Industrie4.0, Industrie du Futur, Catapult*, etc.) across all continents and, at the same time, it produces new business models that affect social life. This turn in our technical, economic and social practices happens as new generations of professionals are animated by evolving ideals, attitudes and self-representations. Engineering educators have to consider them.

For several years, Dassault Systèmes has conducted a worldwide survey, with the participation of the

international student associations BEST and SPEED about students' perceptions of the Grand Challenges for Engineering, a list of 14 megatrends established by the US Academy of Engineering. By comparing outcomes from 2017 with those collected in 2010, all challenges that relate to global warming, as cause or as consequence, progressed significantly on the scale of importance perceived by students. **Are students seeing themselves more as social players than just technicians?**

When asked about competences, a similar shift appears that places human and social skills significantly above the 2010 results. **Are students seeing themselves more as stakeholders in society than just in the economy?**

To those questions, the answer is probably yes and further science may confirm the trend.

The survey supports what all of us have perceived through interactions with the current generation of students: they are more context sensitive and are prepared to broaden their worldviews to give a stronger meaning to their professional life.

Concurrently, coming from the world of employment, industry transformations will have substantial impact on their lives.



“Please rank the challenges that, in your opinion, will drive the largest number of jobs in the 21st century?”



“How needed are the following skills to address Grand Challenges?”

- **Smart Systems** and intelligent machines are taking more and more decisions previously human made. How to program self-driving cars to react appropriately when faced with dilemmas involving potential victims? How to share tasks smartly between operators and collaborative robots? Ultimately, engineers will have new responsibilities in designing the imbedded intelligence of systems, with new, unexpected, impactful consequences of their design decisions. It will be a challenge for educators to make engineering ethics more pervasive in learning content.
 - **The complexity** of socio-technical systems will increase on a resource constrained planet and the context of problems will have to be better understood and considered. The capability to communicate efficiently with environmental specialists, economists, psychologists and social scientists, and even artists will have to be developed and, to this end, authentic project centric learning must be applied more intensively.
 - **Digitalization** of various tasks and processes will enable new business models in which consumer connectivity generates more value than traditional industrial schemes. Agility and creativity that characterized the Silicon Valley are now seen in all industries. Cars are connected mobility devices, kitchen appliances are online nutrition or shopping assistants, medicine and learning are more personalized, etc. Engineering students must be given opportunities to learn digital practices for their many automation applications as well as the lingua franca in engineering projects. With digitalization gaining ground, virtualization of assets and universal connectivity make cyber security more than a subject for specialists but a behavioral trait to cultivate in all engineers.
 - **Globalization**, more than ever requires strong inter-cultural agility, a capability that can be provided only through experiential learning. Engineering across dispersed geographies adds complexities to the creation of competences to work as a team. This complexity can only be overcome with similar methods as those applied in the industry: using visual, interactive and virtual workspaces that connect people technically but also make use of the social network mechanisms familiar to the current generation.
 - **Fragmentation** will characterize careers at different scales. Engineers in startups and industry shakers must not all be entrepreneurs but they have to be able to work within ever changing specifications. Universities should be able to align their collaborative industry projects with the schedules and rhythm of these types of companies. Throughout their professional lives, engineers will have more employers in more diverse sectors. Their capability to adjust to such changes will determine their career success. Learning to learn will be a critical skill that project-centric learning methods provide.
- Dassault Systèmes works relentlessly to develop methods and solutions that sustain the transformation of education needed by students and by the industry to tackle these challenges. From ePBL to systems engineering and from collaborative robotics to IoT or digital manufacturing, we collaborate with educators globally to enhance the digital learning experience. To learn more about methods and tools provided to educators for the Industry Renaissance, visit <http://academy.3ds.com>.



Politecnico di Milano acquired a Total Academic Headcount (TAH) license for MATLAB and worked with MathWorks Training Services to provide students with online and onsite training.

The Challenge

Enable thousands of students to learn essential skills, complete assignments, and conduct research outside the classroom and computer lab

The Solution

Provide students with campus-wide access to MATLAB, online and onsite training, and a MATLAB Associate certification program

The Results

- Classroom teaching time optimized
- Students equipped to complete assignments outside the lab
- MATLAB certifications earned

Prof. Paolo Biscari, dean of the PhD School at Politecnico di Milano. “Last year, we had more than 15,000 active MATLAB users, and our students participated in more than 1000 online training sessions, which reflects how important MATLAB is to our professors and students.”

The Challenge

Previously, professors who taught at the bachelor’s or graduate level had to set aside class time to teach the software skills that students needed for homework, lab assignments, or research projects. Instead of allocating limited classroom time to teaching these skills, the university wanted to provide a flexible online alternative. Further, the university wanted to offer a certification program so that students could demonstrate their mastery of these skills to potential employers.

In past years, the university had to set up computer labs equipped with machines configured with the software the students needed. Not only were the labs costly to maintain, but space was limited—there was no guarantee that students would find a workstation available when they needed it. Politecnico di Milano wanted to provide students with campus-wide access to the software on their own laptops.

The Solution

The TAH license gave students, professors, and researchers university-wide access to MATLAB, Simulink®, and 80 related products. Instead of competing for limited computer lab space, students now complete assignments and conduct research using MATLAB anywhere they want on their personal computers or laptops.

The university organized tutorials consisting of 15 to 20 hours of training delivered over several weeks. The tutorials, which cover MATLAB basics up through advanced topics using specific toolboxes, were attended by more than 500 students last year.

All students were given access to online, self-paced courses on mathworks.com. Hundreds of students completed these courses, which included MATLAB Onramp,



Doctoral students taking the MATLAB certification exam.

MATLAB®. These courses enable students to develop computational and analytical software skills on their own so that professors can focus valuable in-class time on core curriculum material.

“Many of our courses—from the first-year calculus courses at the bachelor’s level to the most advanced courses at the doctoral level—use MATLAB for simulation, laboratory work, and numerical analysis,” says

a two-hour introduction to MATLAB, as well as advanced courses on data processing and visualization, programming techniques, and machine learning.

Prof. Biscari worked with MathWorks trainers to set up a Certified MATLAB Associate program for doctoral students. Of the 33 students who participated in the program in its first year, 29 earned the certification credential.

The university decided not to offer the online courses or training sessions for credit. *“We don’t require students to take a course on MATLAB; they choose to learn MATLAB because they want to develop the skills that will be most useful in their careers,”* explains Prof. Biscari. *“Many students prefer studying and learning by themselves because they feel it sets them apart, and they recognize that improving their personal knowledge is an important part of their education.”*

The Results

- **Classroom teaching time optimized.** *“These days, professors need every hour of class time for instruction,”* says Prof. Biscari. *“Taking time away to teach a software tool is difficult. That’s why the MATLAB online training and the tutorials we provide are perfect for us; they enable students to learn essential skills outside of class.”*
- **Students equipped to complete assignments outside the lab.** *“Previously, we had to provide software and computer labs for students to do their work, and before that it was done with pen and paper,”* notes Prof. Biscari. *“With the TAH license, the university no longer has to provide everything; the students work on their own computers at home.”*
- **MATLAB certifications earned.** *“Most of the 29 doctoral students who achieved MATLAB certification were planning to pursue careers in industry rather than academia,”* says Prof. Biscari. *“They participated not only to deepen their knowledge but also to demonstrate to potential employers that they had mastery of skills that are essential to many fields.”*

[Learn More About Politecnico di Milano](#)

“*At Politecnico di Milano, MATLAB is probably the most used software across different disciplines. We have the highest number of active users and enrollments worldwide for MATLAB online training, which shows that our students recognize the value of learning MATLAB for their research and professions.*”

Prof. Paolo Biscari,
Politecnico di Milano





Preparing Engineering Students to Innovate in a Global Marketplace

Bhavesh Mistry,

Global Head of Academic Marketing, National Instruments

Nancy Dib,

EMEIA Academic Marketing Manager, National Instruments

As the pace of technological innovation continues to increase at a rapid rate, we need engineers who are capable of more. Students entering their engineering careers are expected to effectively address and decipher complex challenges and design solutions to those challenges. In the next five years, we will see transformative changes driven by the first autonomous vehicles, the deployment of 5G, and the increased need for clean energy to power our cities; these changes will be translated into incredible societal impact through the work of today's engineering students.

Preparing students to be the drivers of these megatrends requires more than just traditional engineering knowledge. We must work together to build in each of these engineers the types of soft skills that will play a significant role in their careers.

For example, as we work on increasingly complex systems, future engineers will need to function in expansive, multidisciplinary, and globally distributed teams. They will need to learn how to apply their engineering knowledge to accomplish goals in a timely manner, within design constraints, and in new and innovative ways. Transforming the autonomous vehicle from science fiction to the standard form of transportation in the next 20 years will require developing engineers who can effectively design, prototype, and validate a complex system that merges LIDAR, RADAR, Internet of Things (IoT), vision, and battery management technologies into a single car. To develop this future engineer, we need new approaches and strategies in engineering education.

The Continuing Need for Project-Based Learning and Active Learning

Looking at efforts to deliver on the engineer of the future, we can see the critical role played by project-based learning (PBL). PBL is without question one of the most frequently referenced learning models in education; in

the past decade, it has been transformative in STEM. By applying theory through hands-on activities and authentic design challenges, PBL has changed the approach of engineering education globally.

The key to PBL is that it translates engineering concepts into real-world practice while promoting the development of technical and soft skills (such as teamwork) that are critical in modern engineering positions. PBL ties relevancy to theory and helps students understand the impact of their work.

Building Industrial Relevancy in Alignment with Accreditation Programs

Accreditation initiatives around the globe, such as the European Network for Accreditation of Engineering Education (ENAAEE) and those represented by the [Washington Accord](#), have played a critical role in formulating the standards and guidelines for engineering programs to build the right skills and aptitudes in engineering students. Recent reports such as those from the [American Society of Engineering Education](#) (ASEE) show an increasing need to focus on developing the types of skills that are required to meet not only the criteria of these accreditation programs but also the in-demand needs of employers.

As we begin to map the accreditation standards to the needs of employers, we see the importance of strategies including those of PBL in developing key criteria such as understanding engineering fundamentals, problem analysis, and the use of modern engineering tools in modern practice.

Impact of Collaboration and PBL

The NI academic program has partnered with universities globally to integrate more project-based curricula to deliver impactful student outcomes. The collaborative approach taken in each of these examples has used NI technology as a building block in a larger strategy to connect engineering theory to hands-on activity and authentic design challenges. The results have increased student engagement, reduced student attrition, and driven institutional rankings.

A prime example was the University of Virginia (UVA), which was challenged by high attrition and low student engagement in its Electrical Engineering department. In 2013, the department decided to address the ongoing problem through a comprehensive review of the program.

Faculty members quickly concluded that encouraging students to handle hardware and engage in complex projects from day one would improve UVA's ability to reinforce theory and build relevancy. UVA built a vision around a studio learning approach focused on PBL design and experimentation. The faculty redesigned the curriculum to develop a set of three interconnected courses in circuits, electronics, and signals and systems. For these courses, faculty presented concepts as if they were being taught in a single course. Each course built on another to help students understand concepts by implementing theory in their real-world projects. Students also revisited concepts during all three courses. Seeing the relevance of theory in their projects encouraged them to actively apply what they previously felt were abstract concepts. The impact was almost immediate. UVA reported that 91 percent of students felt that hands-on activity helped them understand the concepts more deeply. In addition, UVA saw that these efforts reversed student attrition, and the Electrical Engineering department rose in national rankings by 16 positions.

Addressing Challenges with an Engineering Education Solution for PBL

By collaborating with schools like UVA, the University of Manchester, the University of Leeds, and Tsinghua University, NI has learned how to help higher education institutions address accreditation guidelines, support teaching technical skills, and build career-ready students who have collaboration, open-ended problem-solving, and teamwork skills.

One PBL engineering education solution NI has developed is the student-centric NI Educational Laboratory Virtual Instrumentation Suite (NI ELVIS) III. It includes the experimentation educators need to teach a foundational engineering curriculum while providing everything required for students to measure, control, and design complex, authentic projects. By integrating every facet of curriculum and PBL into a single solution, NI helps educators focus on developing challenging and engaging exercises on the same software and architecture used by 35,000 companies globally.

The result is an opportunity to improve engagement with an education-focused solution that still enables modern industrial tool usage. For example, Dr. David MacNair at the Georgia Institute of Technology says, "The NI ELVIS is perfect for realizing projects like a [complex] engine system for mechanical engineering students [because]



they can understand signal flow for all of their sensors using the instrumentation, and they can program advanced features in an industrial piece of hardware."

NI ELVIS III is designed to meet the needs of modern engineering education by integrating industry-grade instrumentation, an embedded FPGA target, and web-based access to measurements all in one online curriculum to create a collaborative, active learning environment. With experiments designed by leading educators and industrial partners such as Texas Instruments and Quanser, NI ELVIS III expands to serve a broad set of courses across electrical and mechanical engineering. Wi-Fi, Ethernet, and USB connectivity for both Mac and PCs provides all students need to control, acquire, and process at the edge while helping educators use LabVIEW software to connect to the IT infrastructure for an ever-expanding set of experiments that can teach IoT concepts.

Temple University was one of the first institutions to discover how NI ELVIS III could be used to deliver on the demands of more cutting-edge curricula and incorporate "more hands-on elements into existing classes and [expand] efforts to incorporate project-based learning in more core classes."

Preparing engineering students to deliver on the innovation of tomorrow is the shared responsibility of educators, academic institutions, and industrial partners around the world. Kyle Flessner, vice president of the Technology and Manufacturing Group at Texas Instruments, said, "To become exceptional engineers, students need to be equipped with the right hands-on tools and learning resources. Our collaboration with NI to advance project-based learning using NI ELVIS III is the next step in empowering professors and students and transforming engineering education."

With the right approach and strategy, together we can develop the infrastructure that can both challenge and inspire a generation of engineers to not only tackle megatrends like the IoT but also address global grand challenges in healthcare and the environment.

For more information on NI ELVIS III and the NI academic program, visit ni.com/elvis and ni.com/academic.

Special Contributions

UCL, TU Delft amongst ‘emerging world leaders’ in engineering education

University College London (UCL), Australia’s Charles Sturt University (CSU), TU Delft in the Netherlands and Singapore University of Technology and Design (SUTD) have been cited in a new MIT-commissioned report as emerging global leaders in engineering education.

Dr Ruth Graham’s ‘The global state of the art in engineering education’ interviewed 50 thought leaders in the field, and focussed on the undergraduate programmes offered by the aforementioned institutions. Initiated by MIT as part of their own engineering education development (or NEET - New Engineering Education Transformation), the report examines the institutions’ world-leading undergraduate programmes and pedagogy through case study examples, analysing in-depth exactly how students are being taught differently.

Such recognition by peers is a prestigious accolade for UCL, CSU, TU Delft and SUTD, who are all, despite their

diverse locations and history, advancing engineering pedagogy through innovative programmes and dynamic ways of learning. The report’s case studies were chosen to reflect a variety of approaches and geographical locations, with the Integrated Engineering Programme, UCL’s award-winning teaching framework, praised for the scale of its systemic educational reform; the IEP’s success is examined in more detail below. SUTD was chosen for its design-centred, multidisciplinary and project-based curriculum, which is structured around small group learning; TU Delft’s spirit of innovation from all levels, its design-led curricula, student-led extra-curricular activities and online learning provision warranted its inclusion. CSU Engineering’s innovative programme combines on-campus project-based learning with online and off-campus work-based learning, providing an intriguing example of engineering education delivered very differently.



UCL’s Integrated Engineering Programme recognised as world leader in MIT report

UCL Engineering’s [Integrated Engineering Programme](#) (IEP) – an innovative teaching framework embedded across eight different engineering disciplines, and taught by a total of ten UCL Engineering Departments – is cited as an “emerging engineering education leader” in a new [MIT-commissioned report](#).

‘The global state of the art in engineering education’ by Dr Ruth Graham interviewed 50 thought leaders in the field, with UCL Engineering appearing as one of the top ten cited current engineering leaders, as well as the third most cited emerging leader.

Being recognised in Graham’s report is another welcome accolade for the IEP, which was awarded [Advance HE](#)



UCL Digital Media

(formerly the Higher Education Academy)'s Collaborative Award for Teaching Excellence in 2017.

Whilst UCL's impressive engineering heritage and standing as one of the world's leading research institutions accounts for the current leader reputation, the emerging leader appraisal by peers from across the globe reflects the ground-breaking nature of the IEP. Described in the report as offering a "world-class model" for other engineering education providers, the scale of the IEP was commended by interviewees, who acknowledge the significance of such investment in undergraduate education by a university of UCL's stature.

Developed from a realisation that employers were demanding teamwork, communication and technical skills alongside practical and interdisciplinary experience, c. 900 students - almost the entire UCL Engineering undergraduate intake - begin the IEP each academic year. Differences to traditional engineering programmes include an emphasis on interdisciplinarity, a focus on the aforementioned 'soft skills' of communication and teamwork, and the requirement to study an IEP Minor subject (three related modules on areas ranging from Modern Foreign Languages to Programming, which don't change the students' degree titles, but do offer a chance to explore different disciplines in-depth). Students also regularly put their theoretical knowledge and technical skills into practice via problem-based learning tasks.

IEP Director Emanuela Tilley noted that the report's focus on the IEP "... is testament to just how differently undergraduate engineering is being taught at UCL – and how much our peers are paying attention. Through flagship IEP elements such as [How to Change the World](#) (an interdisciplinary, intensive two-week project based

around various [UN Sustainability Goals](#) for second years and led by our [UCL STEaPP](#) colleagues), a thread of successive problem-based learning activities, and the opportunity to study a different subject area in-depth via the IEP Minor modules, the Integrated Engineering Programme encourages our students to think creatively, collaboratively and with conscience."

With Graham's report anticipating a widespread move towards a "socially-relevant and outward-facing [future] engineering curricula", the social context of engineering already forms a vital part of the IEP. As Emanuela explains, "at UCL Engineering, we trust our students from day one, encouraging them to think and learn differently in the hope and expectation that they will go on to change the world. The global recognition that the IEP is now receiving is welcome evidence that we are heading in the right direction."

Professor John Mitchell, former IEP Director and UCL Engineering Vice Dean Education, stressed how the MIT report is a fitting testament to "all the hard work put into the IEP by its huge, inter-departmental UCL Engineering team ... As the report recognises, the IEP stands out as a model that can be implemented in an established, research-intensive university to enhance the experience of engineering students."

To read Dr Graham's report, visit http://neet.mit.edu/wp-content/uploads/2018/03/MIT_NEET_GlobalStateEngineeringEducation2018.pdf

To find out more about UCL Engineering's Integrated Engineering programme, visit <http://www.engineering.ucl.ac.uk/integrated-engineering/programme-structure/>



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MIT benchmark puts TU Delft at the forefront of innovative education

Massachusetts Institute of Technology (MIT), considered to be the best university of technology in the world, has reviewed the teaching at TU Delft and three other universities of technology as part of its 'educational transformation'. For the benchmark, MIT reviewed and analyzed the most cutting-edge engineering education currently available and the education expected to lead the field in the future. The fifty experts interviewed sometimes placed TU Delft on the list of current leaders and sometimes on the list of future leaders. As a result, TU Delft appears in the top 10 of both lists (4th and 7th respectively).

One of four thought leaders

The factors that led to TU Delft being named as one of the thought leaders include the innovative degree programmes in Industrial Design Engineering and Aerospace Engineering, the fact that TU Delft was quick to offer open and online education, the ambitious, successful student projects, and the decision to invest in the teaching skills of the lecturers. The teaching at four universities deemed 'technical education leaders' by MIT was looked at more closely. Over thirty managers, lecturers, students, alumni and associates were interviewed at each of these institutions.

The Delft spirit

TU Delft stands out from the other three universities under scrutiny because of the way its teaching is developed gradually, step-by-step. Many of those interviewed referred to a Delft spirit and attitude: an open, egalitarian attitude on the part of students and lecturers, as well as managers and university leaders, which enables new ideas and innovative approaches to develop from

inside the university community. Ambitious, successful student projects (such as the Nuna solar-powered car and the Human Power Team bike) were mentioned in this respect. The Delft mentality is linked to Dutch culture, with its predominant values such as inclusion and equality. According to the report, this is also reflected in the Delft management style: successful developments are often created bottom-up with the encouragement and support of management. According to those interviewed, the success of this approach can be seen in the quality of the alumni and the reputation of TU Delft.

'Can-do' engineers' mentality

Alongside inclusion, those interviewed also recognized a 'can-do' engineers' mentality in Delft and a strong will to contribute to a better society. This is apparent in the University's relatively early decision to begin with open and online education, enabling TU Delft to contribute to engineering education worldwide, which in turn has a positive impact on education on the campus. The role of the Vice Presidents for Education (until recently, Anka Mulder and previously, Paul Rullmann), the Director of Education of the Faculty of Aerospace Engineering (Aldert Kamp, for his contribution to the vision of the engineer of the future), and the Director of Education & Student Affairs (Timo Kos, for the success of open & online education in the Extension School) and the support organization, received explicit praise. The authors expect educational innovation to continue in the years to come, partly thanks to the founding in 2017 of the Teaching Academy (which helps lecturers at Delft to develop their teaching)

Author: TU Delft Communication

Life in a Fish Bowl: A Conversation on Inclusive Efforts in Engineering Education

Teri Reed, Ph.D.

There is a common strategy to creating conversations on diversity, equity, and inclusion, which is one of using parables, analogies, and thought-provoking questions. The desired outcome is to create a common language to assist with open conversations on topics that can be difficult and uncomfortable. In this discussion, I will begin with a parable, move to several analogies, and conclude with a thought-provoking question.

I am often asked to speak on diversity, equity, and inclusion and I like to begin the conversation with the following parable:

One morning, two fish are swimming in a pond. They happen along a frog swimming in the opposite direction. The frog says, "Good morning. How's the water?" The fish have no idea how to respond. They are completely baffled. They have no idea what "water" is. They have always been surrounded by water and know nothing different.

In discussing this parable, David Foster Wallace (2005) reminds us that "...the most obvious, important realities are often the ones that are hardest to see and talk about." When we are surrounded by people who think similarly and all share the same "universal truths," it is difficult to see that these are only universal within our own local cultures (Hansen, 2010). Our cultures suspend and envelop us in a web of shared meaning-making (Geertz, 1994). Like the fish, we are blind to the assumptions that weave the fabric of meaning in our lives and, perhaps most importantly, in our own departments or professional working environments. We are blind to our own assumptions about reality, our cultures of origin. Often the only way we can see the "water" (i.e., our culture) is to step outside of it (Groll, Reed, Cox, 2015), but we should at least try to examine our own assumptions of our "water" and how others exist (or not) in this environment.

Like fish discussing water, humans often find it difficult to discuss culture. There are numerous and differing definitions of culture (Kroeber & Kluckhohn, 1952), with the very definition of culture being influenced by the cultural setting in which it is being discussed. Culture is all around us, impacting "our important realities," yet we are often blind to the experience of it. With the knowledge from the fish parable, let's move to an analogy meant to further highlight culture in an easy, non-threatening, non-critical way. This is called the handedness exercise. Again, a very simple example of asking participants to

Handedness Debrief

- Handedness is not chosen or bestowed (unearned privilege).
- Right handedness is considered normal, while left handedness has historically been perceived as deviant, dangerous, and sinister (concept of domination).
- The society may view left-handed people as awkward or strange, and left-handed people often believe this about themselves (internalized oppression).
- Left-handed people frequently change their behaviors to fit into a right-handed world (assimilation and code shifting).
- Right-handed people are unconscious of the benefits they receive (the privilege of ignorance).
- Right-handed people cannot avoid the benefits they receive, even when they are conscious of the benefits (institutionalized and systemic nature of privilege).

(<http://www.diversityweb.org/DiversityDemocracy/vol11no3/gilbert.cfm>)

complete a task in a short time, but in this case using only their left hand. Sounds easy, right? Well for left-handed persons, it is (and you will have to enforce that left-handed people should use their left-hand). For right-handed persons, who will typically be the majority of any group, it is not so easy. Make sure to time this and try to ask something where persons need to think while writing quickly. Examples of this vary by audience and allotted time. I have quizzed students (and graded the quiz so it had to be readable), asked dean's to write their college's diversity statement (usually in 2 minutes), and asked faculty to make a list of 10 adjectives describing their fish bowl (again 2 minutes). You can also ask people to write their name, title and description of their research for others to use to introduce them, or ask for a simple fill-in-the-blank sentence such as "Engineers are _____" (allow 1 minute). In the case of administrators,

faculty, and staff, I always tell them they will be exchanging their writing with a near peer for a report out, so it must be legible.

The handedness exercise introduces culture and ultimately privilege in a non-threatening and highly discussable way. In the debriefing of this exercise, note people's experiences such as "This is hard," "This is unfair," "This was great. As a left-handed person, I never get the advantage," for example. People accept this means of introducing privilege with handedness as uncontroversial because it is seen as unearned and is readily accepted as a privilege. It is easy to relate to engineering design and related safety, as well. Although privilege is not necessarily chosen, for example the right-handed person's advantage over the left-handed person, it is also not usually noted by the possessor either.

This leads us to another fish and water analogy used by Dr. Noma LeMoine to discuss the experience for those from marginalized cultures or cultures that differ from the dominant culture (2014). The question to be posed here is on the experience of saltwater fish in a freshwater pond. The answer - the salt water fish bloats and dies a slow and very painful death. LeMoine (2014) compares this to the experience of underrepresented students who enter a university system and are expected to survive. The same can be said for persons in academia or industry.

Advancing beyond our fish analogy, we need assistance to develop our thinking from diversity (representation) to inclusion (participation). It is not enough to have various underrepresented populations merely present and surviving. These persons need to feel welcome to live; contribute; and, ultimately, thrive. A newer analogy which assists in moving us from diversity to inclusion is the following:

“Diversity is being invited to the party... inclusion is being asked to dance.”

author unknown

As a final question, who is dancing at your party and what can be done to make sure all feel welcome to dance their own dance? Not only should we help others survive in our “brackish” environments, but how do we change our environments? Consider activities such as bystander and implicit bias training. Consider language awareness and pronoun usage (e.g., can the general “engineer” used in everyday examples ever be referred to as a “she” or other feminine pronoun?). Consider Male Advocates and Allies programs (Bilen-Green, et.

al., 2015) and implementing an interview protocol of asking all administrators their philosophy on inclusion (Holloway, 2015; Deyton, et. al., 2015; WEPAN, 2018). So as you take the path from parable to analogy to thought-provoking question, I challenge you to step out of your own water, critically examine who is just surviving in your water, and then consider not only the invitation list, but who is really dancing at your party.

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