IEEE EDUCON18 Global Engineering Education Conference



IEEE Education Society



Welcome address

It is a great pleasure for us to declare open the EDUCON2018 – IEEE Global Engineering Education Conference - Emerging Trends and Challenges of Engineering Education and to welcome the 363 participants from 50 countries all over the world who came here to exchange experience and work together a few days on the exciting field of engineering, education and their applications. I first wish to extend to you the greetings of the Board of Universidad de La Laguna, Universidad de Vigo and Universidad Nacional de Educación a Distancia. Specially, I want to remark to IEEE and its Education Society for their support to this Conference.

We are delighted to have you here to participate and share in the hosted by Universidad de La Laguna. Thank you for coming. That many of you travel long distances serves to remind us all just how important our work is.

We have the privilege of holding our conference in the beautifully equipped buildings of the International Trade Fair and Conference Centre, Santa Cruz de Tenerife. I wish to thank warmly to our committees: Steering Committee, Academic Committee, Technical Committees and the Reviewers for make possible this Conference. And specially to our technical staff: ULLMEDIA, UDV, Teaching Vice-chancellor staff plus Voluntaries of ULL and MagnaCongresos, whom has been very decisive in the conference performance.

In these times calling for social relevance of scientific activities it is very fortunate to see the important part taken in this conference by applications.

We have the opportunity to have relevant Keynotes such as Marina Umashi Bers from Tufts University, who co-developed the Scracth Jr Language and created the KIBO Robot making available worldwide and committed to coding as a new literacy, Claudia Urrea from MIT who is working at the Strategic Educational Initiative of MIT as Associate Director for pK-12 of the Abdul Latif Jameel World Education Lab (J-WEL) and José Carlos Quadrado from the Instituto Politecnico do Porto who is an international leader in engineering education.

Besides, we would to thanks to the organizers of 13 Special Sessions, 10 Workshops and 3 Round Tables leaded by companies and academics.

We have to extend further thanks to our sponsors who greatly helped in organizing the conference. MathWorks, Cypress, Pentec Blackboard and UNIR iTED as our Silver Sponsors and Coplaca, Fuentealta, Sociedad de Desarrollo del Ayuntamiento of Tenerife and Grupo Visual Canarias as our General Sponsors, and the supporting of the Cabildo de Tenerife.

We want all academics, regardless of race, creed or circumstance to achieve their full learning potential. Our task is to make it possible. Our mission is to provide practical, step by step assistance. Thanks to all authors and co-authors, presenters and participants on this EDUCON 2018 edition.

Prepare yourself to be challenged, excited and inspired. Collaborate, participate, engage, be one of the key attendees on all events, enjoy Tenerife in EDUCON 2018, and see you again in EDUCON 2019 in Dubai.

Carina Gonzalez, Manuel Castro and Martin Llamas General co-chairs of EDUCON 2018

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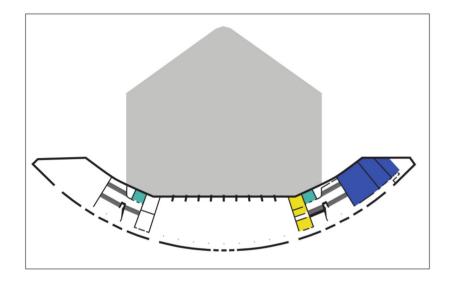
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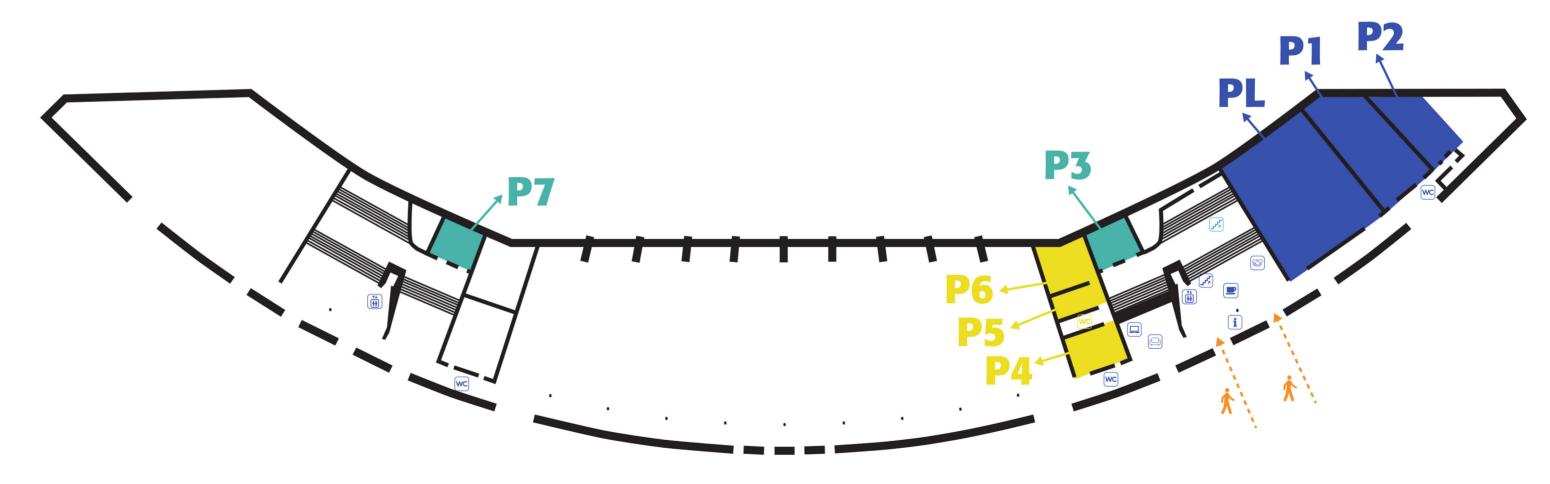
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8.00 am		Registration open	Registration open	Registration open
		Opening Ceremony and Plenary Session	Special Sessions	Sessions
9.00 am				
10.00 am		Coffee Break Sessions	Coffee Break Plenary Session and Distinguished Award	Coffee Break Plenary Session and Educon 2019 presentation
11.00 am				
12.00 am		Round Table Future Global Computing Education within the Context of CC2020	Round Table Addressing the Gender Gap / Exploring Trust and our Unconscious Bias	Round Table Gender & Engineering / Influence of companie and technological communities to minimize the gender gap in the STEM field
1.00 pm	Registration open	Lunch Ebano Eventos Lounge & Terrace	Lunch Ebano Eventos Lounge & Terrace	Lunch Ebano Eventos Lounge & Terrace
2.00 pm				
3.00 pm	Wokshops	Sessions	Special Sessions	Sessions
4.00 pm				Plenary Session, Awards Session and Closing Ceremony
5.00 pm				
6.00 pm	Tea/Coffee Networking			
7.00 pm	Cultural Event - Guided visit Museo de la Naturaleza y el Hombre			
8.00 pm		Welcome Reception Auditorio de Tenerife "Adán Martín"		
9.00 pm			Conference Gala Dinner Real Casino de Tenerife	
10.00 pm				

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	Cultural Event - Guided visit
	Las Cañadas del Teide including visit of the Teide Observatory
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EDUCON 8 Global Engineering Education Conference







First Floor

- P4 Parallel 4
- P5 Parallel 5
- P6 Parallel 6
- 📋 Elevator
- 考 Stairs
- vc **Toilet**

Keynotes

Marina Umashi Bers

Tufts University (USA)



Marina Umaschi Bers is a professor at the Eliot-Pearson Department of Child Study and Hu-Developman ment and an adprofessor junct in the Computer Science Department at Tufts University. She heads the inter-

disciplinary Developmental Technologies research group. Her research involves the design and study of innovative learning technologies to promote children's positive development.

Prof. Umaschi Bers is from Argentina, where she did her undergraduate studies in Social Communication at Buenos Aires University. In 1994 she came to the US where she received a Master's degree in Educational Media and Technology from Boston University and a Master of Science and PhD from the MIT Media Laboratory working with Seymour Papert. Prof. Umaschi Bers has three children.

Prof. Umaschi Bers received prestigious awards such as the 2005 Presidential Early Career Award for Scientists and Engineers (PECASE), the highest honor given by the U.S. government to outstanding investigators at the early stages of their careers, a National Science Foundation (NSF)'s Young Investigator's Career Award,for her work on virtual communities of learning and care, and the American Educational Research Association (AERA) Jan Hawkins Award for Early Career Contributions to Humanistic Research and Scholarship in Learning Technologies.She was also selected by the Boston Business Journal as one of the recipients of its 2015 Women to Watch in Science and Technology awards.

Since the mid 90's, Prof. Umaschi Bers has conceived and designed diverse technological tools ranging from robotics to virtual worlds. Her recent research focuses on how new technologies such as robotics and programming languages, that extend the possibilities of traditional learning manipulatives, can be successfully used to promote math, science, technology and engineering education in early childhood alongside with socio-emotional development and the arts. For example, she co-developed the ScratchJr programming language in collaboration with Mitch Resnick from the MIT Media Lab and Paula Bonta, from the PICO company. ScratchJr is a free app funded by the National Science Foundation, the Code to Learn Foundation and a very successful Kickstarter campaign.

Prof. Umaschi Bers also developed the KIBO robot kit for children 4 to 7 year old, that can be programmed with wooden blocks without using keyboards or screens old and co-founded a start-up, KinderLab Robotics, Inc that with funding from the National Science Foundation SBIR program, is commercializing KIBO and making available worldwide.

Prof. Umaschi Bers is passionate about using the power of technology to promote positive development and learning for young children. Check out her 2014 TEDx talk "Young programmers — think playgrounds, not playpens".

Prof. Umaschi Bers teaches seminars and professional development institutes on learning technologies for early childhood educators and does consulting for toy companies and educational organizations that want to take advantage of the power of new technologies for young children. She has conducted studies and done work in after school programs, museums and hospitals, as well as schools and preschools. She has worked in the US, Argentina, Colombia, Spain, Costa Rica, Singapore and Thailand.

Claudia Urrea

MIT (USA)



Claudia Urrea has over 20 years of experience in the field of Education and Technology. Claudia Urrea is currently working at the Strategic

Educational Initiative within the MIT Office of Digital Learning in strategy, management and coordination for the new PreK-12 Initiative. Claudia Urrea has worked at the Interamerican Development Bank as a consultant in the Education Sector, and 5 years at One Laptop Per Child organization as Director of Learning. Her areas of interest include online learning and assessment, curriculum design, preK-12 and higher education, education for developing countries, teacher professional development, educational programming and robotics, and maker education.

Claudia Urrea was born in Colombia, where she received an undergraduate degree in Computer Science from EAFIT University. In the mid 90s, she moved to the US, where she received her Master's degree in Educational Media and Technology from Boston University, and her doctorate degree from the MIT Media Laboratory. Her PhD thesis studied the implications of one to one learning in a rural setting in Latin America. She has helped multiple governments and non-government agencies to empower and support schools and communities of learners to evolve from traditional teaching methods into progressive learning environments.

Dr. Urrea has also a research scientist position with the Lifelong Kindergarten group at the MIT Media Lab. She has taught several classes at the Harvard Summer Program and Early Childhood Development program at Tufts University. She has consulted with international and multi-sectoral organizations such as the Inter-American Development Bank and Schlumberger Excellence in Education Development-SEED.

José Carlos Quadrado

Instituto Politecnico do Porto (IPP), Portugal



Jose Carlos Quadrado, is an international leader in engineering education. He is a fullprofessor at the Instituto Politec-

nico do Porto (IPP), one of the leading and most prestigious engineering institutes in Portugal.

He holds a Bachelor's degree in Energy and Power Systems, a diploma in Electrical Engineering, Automation and Industrial Electronics, a Master's and a Doctoral degree in Electrical Engineering and Computers from the Lisbon University. He also holds the Habilitation degree (Aggregation) in Electrical Engineering from Beira Interior University.

Innovative, good communicator and experienced in the field of Engineering he is the pastpresident of the International Federation of Engineering Education Societies (IFEES) as well as past-president of the Ibero-American Engineering Education Association (ASIBEI) and past-VP of the European Society for Engineering Education (SEFI).

Being a former member of the National Bologna Expert Group, he has led the Portuguese Observatory on Best Practices on Strategic Management as well as the National Association of Deans of Engineering. Being a senior member of several engineering societies and engineering education societies, in several continents, he is also a visiting professor in many universities around the world.

He has been involved in more than 200 international publications, patents and has been the recipient of international technical awards and scholarships.

He is the Peter I, 2017 medallist, the most pres-

tigious award given by the Russian Engineering Education Association. He has also occupied editorial positions in scientific journals. His academic work is mostly related to the fields of renewable energy, fuel cells, electric vehicles and intelligent control.

Round Tables

(RT2) Future Global Computing Education within the Context of CC2020

Chairs: Impagliazzo, John; Pears, Arnold Neville

Room: 340 people plenary room with speaker and presidency table located in the basement at the right of the reception

Date and time: 2018-04-18 12:00

Participants attending the conference roundtable contribute to the Computing Curricula 2020 (CC2020) project effort by engaging in dialogue and debate on the future of computing education on a global scale. The CC2020 project, supported by the Association for Computing Machinery (ACM) and the IEEE Computer Society, aims to generate a futuristic document useful to educational institutions worldwide.

The main objective of the roundtable is to explore key aspects of computing education in 2030. These characteristics could involve degree programs, ways of learning, curricular content, learning tools, or any other aspect that could affect computing education. A secondary objective is to capture innovative ideas for the CC2020 project such as visual representations of computing degree programs and the use of modern tools for program delivery. The overall goal of the roundtable is to generate forward-looking, global content for the CC2020 project.

The facilitators of the roundtable will inform participants on the goals of the CC2020 project and allow them to propose futuristic ideas toward the development of computing education. After presenting a brief high-level summary of the CC2005 report and the aspirations of the CC2020 project, the facilitators will engage the participants in an exploration of ways to fulfil the project objectives. The aim is to generate diverse opinions and vigorous discussion on the future of computing education as reflected in the pending CC2020 report. The roundtable should not exceed ninety minutes.

The Association for Computing Machinery (ACM) initiated a review of the document titled, "Computing Curricula 2005: The Overview Report" (CC2005) [1]. It wanted to take a fresh approach to the ensuing CC2020 project, which includes current advances in pedagogy, technology, and curricular development as well as being futuristic and global in scope. The ACM assembled a task force and invited several computing organizations to support the endeavor such as the IEEE Computer Society. It was incumbent on the CC2020 project to structure a working task force with global representation, provide forward-looking digests of educational practices in computing fields on a global scale, and to project how computing education could evolve over the next ten years. The task force comprising thirtysix people representing organizations from sixteen countries and six continents, has already agreed that the word "computing" be the umbrella term for all computer-related areas, and embraced the use of "competency" to describe student achievement, where

Competency = Knowledge + Skills + Dispositions

describes the level of student performance at the time of graduation.

John Impagliazzo (Hofstra University) is a member of the steering committee of the CC2020 project. He was chair of the committee that produced the computer engineering curricular report (CE2016) [2] and was an active member of the CC2005 project, making him an indispensable contributor to the CC2020 project. John is an IEEE Fellow, an IEEE Life Member, and an ACM Distinguished Educator. He moderates the roundtable.

Arnold Neville Pears (Uppsala University, KTH Royal Institute of Technology, Sweden)

is a member of the steering committee of the CC2020 project. He has extensive curriculum development experience, has served on the Board of Governors of the IEEE Computer Society (2012-2014), and is director-elect to the Board of Governors of the IEEE Education Society (2018-2020).

(RT2) Addressing the Gender Gap / Exploring Trust and our Unconscious Bias

Chairs: Strachan, Rebecca; Emembolu, Itoro Charles

Room: 340 people plenary room with speaker and presidency table located in the basement at the right of the reception

Date and time: 2018-04-19 12:00

There is still a large gender gap across the technology, engineering and physical sciences disciplines despite a number of efforts over the past three decades to address this. Creating a more diverse workforce including a better gender balance is important in order to meet the skills need of the future. There is also increasing evidence that organizations with a more diverse workforce are more creative and innovative and ultimately perform better and are more successful. In this Round Table, three women will present their lived experiences of being female in the engineering sector. This will be followed by an interactive session allowing the audience to explore their own unconscious bias and levels of trust. In conclusion, the session will open up to a wider discussion where the audience is invited to give their feedback and contributions to this important issue, and how we should be tackling it as a collective community across the sector.

An environment of diversity and inclusion is very important at every stage of a person's life. If females do not feel welcome or included in their workplace or educational institution, they will often find it difficult to identify with and we will continue to find it challenging to attract and retain females across the engineering and technology disciplines. Just as different factors impact on this issue, different solutions are required to reduce the gender gap. These include awareness of one's own bias and 'circle of trust' and taking active action to mitigate these, thus providing educational and workplace environments that are welcoming and value each and every one of us. Gender and other stereotypes will not just disappear overnight but can be systematically changed over time. For example, females in the discipline can be STEM ambassadors for others.

The panel presenters, despite all the different challenges and bias experienced by them, all find the STEM careers they have chosen rewarding and would still pursue their chosen career in retrospect. Through this round table, there will be the opportunity to discuss and explore issues with the audience and panel and examine how we can move this agenda forward as a collective community across the sector.

The round table will be divided into three main blocks. The first block is intended to introduce the main issues and provide a lived perspective from the three female panelists. The second block introduces an interactive element and invites the audience to explore their own unconscious bias and trust through a short presentation and follow up exercise. The final block provides time for invited questions from the audience and a more in depth discussion on these issues and how to address them.

Dr. Rebecca Strachan is Professor of Digital Technology and Education and Associate Pro Vice Chancellor for Knowledge Exchange in the Faculty of Engineering and Environment at Northumbria University. A leading expert in the exploitation of digital technologies to improve daily life she believes we should be using technology in transformational ways to support students and open up opportunities for all. A committee member of the IEEE Education Society, she was part of the team to develop their MOOC on Open Education.

Dr. Aruquia Peixoto is an Assistant Professor

at CEFET/RJ in Rio de Janeiro, Brazil. She has been passionate about research since she was a young girl and enjoys her research in computer graphics and education, especially linked to the important and developing themes of gender, diversity and inclusion. Since 2016 she is a member of the ACM Council for Women, as SIG Liaison. For IEEE EDUCON 2018 she is Chair of the Special Session IDEE (Inclusion and Diversity in Education Engineering), and Chair of the Publication, Web and eMedia Committee.

Itoro Emembolu is a PhD researcher in the Faculty of Engineering and Environment at Northumbria University. Her research is on evaluating the impact of academic research on young people's uptake of the STEM disciplines, Itoro has a BEng in Mechanical Engineering, and Masters qualifications in International Business, Energy and Petroleum and Management. She is interested in raising aspirations and widening awareness of STEM careers and their pathways in young people.

Dr. Maria Teresa Restivo has a Physics degree in Solid State Physics and a Ph.D. in Engineering Sciences and joined the University of Porto's research Unit on System Integration and Process Automation (UISPA) integrating the Associated Laboratory of Energy, Transports and Aeronautics (LAETA). She has coordinated it since December 2007. She is a member of the Scientific Council at FEUP. She focuses on sensor development, wireless sensorization, online experimentation, and development of sensorized devices. She is Executive Committee member of GIP - International Society for Engineering Education (Sep. 2010 ->) and Executive Committee member of the International Association of Online Engineering (IAOE).

(RT3) Gender & Engineering / Influence of companies and technological communities to minimize the gender gap in the STEM field

Chairs: Martinez, María de los Angeles; González González, Carina Soledad

Room: 340 people plenary room with speaker and presidency table located in the basement at the right of the reception

Date and time: 2018-04-20 12:00

Gender inequality is a worldwide problem, but is especially latent in the context of the Science, Technology, Engineering and Mathematics fields especially at university level and thus labor. Low female participation in STEM has been identified as a priority in the European Union. The EU tries to close this gapby developing support programs through various organizations such as EPWS, WITEC and projects as SESTEM (The European Scenery on Gender and STEM), GENDERA good practice (www.gendera.eu), Genset in gender action plans inscience, among others. In 2013, the report "Women in Technology: Leaders of Tomorrow" by The Glass Hammer and sponsored by Accenture, based on interviews with 200 women, but mainly Yorkers technology sector junior or intermediate level worldwide, evident that the number of women in thesector is less than 30 years ago: In the 1980s, women represented a peak of between 35 and 40 percent of the computing and information technology (IT) workforce in the U.S. By 2011, that percentage dropped to about 25 percent, according to NCWIT. We can also cite as an example the Spanish university system, according to the report published by the Ministry of Education, Culture and Sport, 54% of university students are women, in fact, in the most degrees the presence of women is majority, but if we focus on engineering studies and architectural, the number of women is almost reduced to a quarter of all students, except for industrial design where there is a greater presence of women.

Since 1983 there have been numerous reports of problems with education in science and mathematics, as well as recommendations for improvements in education such as using active learning, participate in projects, implement the presence of mentors, etc. but these measures are not aimed at improving the situation of students with smaller presence in these areas such as, on the one hand, women, and on the other, other minorities. In this regard, women can be considered a minority within the context of STEM studies due to their lack ofpresence, not as minorities in society.

Some questions:

Why are there so few female engineers? What factors influence?

Why is there such a persistent gender gap in engineering?

What steps are being taken to improve the situation?

Why do women who study engineering leave to pursue careers in other fields?

Is unconscious bias training effective in ending discriminatory practices?

Do women suffer from a so-called "self-confidence barrier"?

How can we improve workplace climate to retain female engineers?

Is it necessary to create development communities just for women?

What strategies can be designed to attract women to software communities? and which strategies are you applying ?

What kind of results are you getting? Is there any data that highlights or marks a point of inflrexion?

Your communities and actions are aimed for technological women, what age range are you targeting? How do you approach the actions according to the age range?

Panel Members

Moderators

• Mariel Martínez Estévez is computer engineering, co-funder of Tech&Ladies and Women Techmaker Lead. • Alicia Martín Fernández works in Department of Innovation Programs in Education for Omnia Infosys, also collaborates with Google for Education and Microsoft Education.

Panelists

• Alicia García Holgado is a PhD student in Education in the Knowledge Society at the University of Salamanca, Organizer at Google Developers Group of Salamanca and is member of the Women Techmakers Leads. • Cristina Aranda is PhD, Theorical and Applied Linguistics, CMO at Intelygenz & Cofounder-Director of MujeresTech. • Maica Gil is Co-Organizer at SF International Women Entrepreneurs Forum. She knows the connections in the ecosystem of technology, entrepreneurship and women. Talia S Gershon her undergraduate degree at MIT in Materials Science, and her PhD at the University of Cambridge as a Gates Scholar. She is Senior Manager, AI Challenges and Quantum Experiences at IBM Research. • Ainhoa Marcos is an expert in the field of implementing technology in the classroom. With more than 7 years of experience working in technology companies, like SMART or Microsoft, in Spain and in the USA. • Andres L. Martinez-Ortiz is Developer Program Manager at Google, promoting initiatives for developers in Spain, Europe and LatAm. Member of IEEE, Linux Foundation and ACM.

Workshops

(WS1A) Workshop: Using the Up to University Platform on the Education

Chairs: Grammatikou, Mary; Szegedi, Peter

Room: 50 people, theater style, 3 people presidency table, video projector and computer, area mezzanine up of the conference center

Date and time: 2018-04-17 15:00

Up2U workshop will make the audience familiar with an advanced digital platform that has been developed in Up2U project (https://up2university.eu/). Up2U project's goal is to bridge the gap between secondary schools and higher education & research by better integrating formal and informal learning scenarios and adapting both the technology and the methodology that students will most likely be facing in universities. Up2U is designing, developing and deploying a Next Generation Digital Learning Environment - NGDLE with existing components, where possible using open source software, that are glued together in a specific way. In contrast with the market leaders who obviously put their particular products in the centre of their universe, Up2U is putting the emphasis on interoperability, modularity and portability.

To provide the LMS component of the Up2U prototype, the Moodle platform was selected, as a very widely used and supported LMS, of which multiple partners in the project have experience. As well as good support for interoperability standards such as LTI and xAPI, Moodle has an extensive set of available core and third-party plugins which enable the user experience on both desktop and mobile devices to be customised and extended with a wide variety of features, giving us future scope to tailor what users see according to the learning scenarios we intend to cover. The tools that are currently integrated and they will be also demonstrated in the workshop are: Moodle (LMS), ownCloud (Doc Sharing), eduOER (Content Repository), PuMuKIT (Video Platform), Learning Locker (LRS), SeLCont (Synchronized eLearning Content ToolKit), Opencast (Educational Multimedia Content Management), (Recording), WebTUT (Tutoring Application), H5P (Content Creation and Sharing), Commonspaces (Common Spaces for collaborative learning).

The workshop will inform the community about what the Up2U platform offers to the education in high schools environment and will train them on the Up2U modular platform. The full functionality of the platform will be demonstrated during the workshop and a "hands on experience" will be available for an in depth platform understanding. The teachers will have the opportunity to work with the platform and to make their own experience with the different tools of the Up2U architecture. A user guide will be available to the audience for a better understating of the platform functionality. This will be a real experience, of using the Up2U platform.

Peter Szegedi (male) has a background in the telecommunications industry and lately he joined the leading ICT and networking organization of the public research and education sector GÉANT (formerly known as TERENA). GÉANT is a fundamental element of Europe's e-infrastructure, delivering the pan-European GEANT network for scientific excellence, research, education and innovation. Peter is the member of the Chief Community Support Office where he develops and manages the task forces, special interest groups and contributes to technical projects and strategic programmes, such as the Up to University (Up2U) Project. As the Senior Cloud Services Manager, he contributes to policy definition and implementation of the GÉANT Community Programme in the area of clouds and educational services support.

Dr. Mary Grammatikou (female) – is a Se-

nior Researcher at the NETMODE laboratory of NTUA and Teaching Fellow at the School of Electrical & Computer Engineering of NTUA. She obtained her Diploma and the PhD degree in Electrical and Computer Engineering, both from NTUA. Her main research interests lie in the areas of service management, SDN technologies and NFV architectures, security, network virtualisation, e-service architectures and cloud computing, while she has been involved in various relevant RTD projects (e.g. NOVI, Fed4FIRE, EFIPSANS, OpenLab, GN3, GN3PLUS, GN4). She has She has an extensive experience in software systems design & development and she has participated in many European projects. She has been member of the Technical Program Committees (TPCs) in several International Conferences (e.g. IEEE MENs, GlobeCom, CloudCom, SAM). She is a member of IEEE, TEE, WG7/TC48 Working Group and also of OGF, TM and DMT Forums.

Using the Up to University Platform on the Education

Authors: Grammatikou, Mary; Szegedi, Peter

Organisations: National Technical University of Athens, Greece; GÉANT Association, Amsterdam, NL

The key objective of the workshop is to make the audience familiar with an advanced digital platform that has been created in Up2U project (https://up2university.eu/). Up2U project's goal is to bridge the gap between secondary schools and higher education & research by better integrating formal and informal learning scenarios and adapting both the technology and the methodology that students will most likely be facing in universities. The project is focusing on the context of secondary schools, often referred as high schools. Up2U is designing, developing and deploying a Next Generation Digital Learning Environment - NGDLE with existing components, where possible us-

ing open source software, that are glued together in a specific way. In contrast with the market leaders who obviously put their particular products in the centre of their universe, Up2U is putting the emphasis on interoperability, modularity and portability. Pedagogically, the use of Up2U tools and methodologies has advantages as it emphasizes to the discovery, exploration and construction of knowledge through active and interactive learning environments, and learning multisensory experience through digital approaches. The scope of the workshop is to inform and train the community in practice about what the Up2U platform offers to the education in high schools environment and make the audience understand well the Up2U modules. Finally, a "hands on experience" will be available to support audience on understanding the platform in depth. The main integrated tools (modules) in Up2U platform are: Moodle, eduOER, SeL-Cont, PuMuKIT, ownCloud, Learning Locker (LRS), openCast, Galicaster, WebTUT, H5P, Commonspaces.

(WS2) Workshop: How to Adapt Effective Teaching Tools from Other Disciplines for Engineering Classrooms

Chairs: Kurdia, Anastasia

Room: 340 people plenary room with speaker and presidency table located in the basement at the right of the reception

Date and time: 2018-04-17 15:00

It is surprising how many problems in education are common across fields while effective approaches of addressing them remain restricted to specific subjects or discipline areas, and are nearly unknown and unused in other areas. The goal of this workshop is to equip the participants with research-backed teaching tools from different disciplines. The target audience includes both educators who are just beginning to explore the methods for increasing efficiency of their instruction and are looking for an introduction to active learning techniques, and experienced instructors who would like to enrich their teaching approach with techniques from other disciplines. This is a general-interest halfday workshop for engineering educators of undergraduate, graduate, and high -school levels and for all experience levels with active learning. No special equipment is needed, and advance preparation is optional: in order to maximize the effect of the workshop, participants are encouraged to inquire about a field of study different from the one that they teach and familiarize themselves with the teaching methods used in that field. Printed and electronic version of learning materials, and references to cited sources will be provided.

Preliminary agenda Introduction, which highlights the common problems in engineering education and common approaches to solving them. Presentation of several fields from which engineering educators can borrow standard and simple efficient teaching tools, and practical advice on implementation. Tentatively, these fields include:- Sciences and engineering disciplines (process-oriented guided inquiry learning (POGIL), concept inventory, peer instruction)- Language education (blended learning, mother tongue mirroring, integrated skillteaching)- Studio arts (portfolio building, critique and observation sessions, studios)- Humanities (collaborative learning) Practicum, in which participants begin development or redesign of the learning materials for their own discipline, followed by a discussion of their experience. Discussion of online transfer and scalability issues.

Anastasia Kurdia, Ph.D. is a Professor of Practice of Computer Science and Undergraduate Coordinatorf or Computer Science at the School of Science and Engineering at Tulane University, USA, where interdisciplinarity is highly emphasized in Computer Science education. How to Adapt Effective Teaching Tools from Other Disciplines for Engineering Classrooms

Authors: Kurdia, Anastasia

Organisations: Tulane University, United States of America

It is surprising how many problems in education are common across fields while effective approaches of addressing them remain restricted to specific subjects or discipline areas, and are nearly unknown and unused in other areas. The goal of this workshop is to equip the participants with research-backed teaching tools from different disciplines. The target audience of this general-interest half-day workshop are the engineering educators of undergraduate, graduate, and high-school levels, and of all experience levels with active learning.

(WS3) Workshop: Driving lights through robotic educational

Chairs: Plaza Merino, Pedro; Peixoto, Aruquia

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-17 15:00

Robotics and computational thinking are ideal tools for developing STEM (Science, Technology, Engineering and Mathematics) pedagogy. Nowadays, robotic education tools arise with the aim of promoting the innovation and the motivation of the students during the learning process. Robots are becoming more common in our daily life; thus, it is important to integrate robots at all levels of our society. This workshop is focused on driving the same content across three different low-cost robotic educational tools. The first one is Scratch, interactive stories, games and animations can be programed. The second tool is Crumble, it is an easy-to-use programmable controller. Its programming interface uses a block programming language which eases its use by children aged below 14. The last but not the least is Arduino, Arduino is an open-source electronics platform based on easy-to-use hardware and software. It is a platform that incorporates a simple microcontroller and an interface development environment to create the applications to be downloaded into the board. This workshop is aimed to present the mentioned platforms as robotic educational tools for people as the first step to get into robotics world. Throughout this workshop an initiation to robotics is developed in the context of educational robotics.

I. Preliminary agenda

This workshop is intended to be deployed for 90 minutes. The agenda is divided in five main blocks. The first block is intended to introduce STEM pedagogy and robotics education as the underlying background of this workshop. Furthermore, an overview of the workshop is provided too. In a second step the Scratch tool is presented, and the multi-platform content is deployed based on Scratch. In a second step the Crumble tool is presented, and the multiplatform content is deployed based on Crumble. As the third step, the Arduino tool is presented, and the multi-platform content is deployed based on Arduino. Finally, some time is reserved to discuss about the content and the experiences.

A. Workshop background and overview (15 minutes)

Robotic education is becoming very popular these days. Simple robots are being used within STEM (Science, Technology, Engineering and Mathematics) Education as a powerful tool which eases the way to teach STEM knowledge. Additionally, Robotics also provide an attractive manner to transform concepts that are perceived by students as boring into an amusing learning process. Robotics is being used as the modernization and improvement for most of processes. This occurs as result of robots can be easily integrated within the current industrial processes. Furthermore, the robotics has become an important tool for the students to be involved in STEM. Nevertheless, the introduction to the robotics is not a simple task. First, the robotics combines mechanics, electricity, electronics, and computer science with the purpose of designing and building robotics applications. Robots are programmable electromechanical machines that include sensors and actuators to make decisions and adapt to different situations. Hence, the first step to be introduced into the robotics should be the acquisition of programming skills and basic mechatronic skills.

B. Driving lights with Scratch (20 minutes)

Scratch was developed by the MIT (Massachusetts Institute of Technology) Education division. The mission of the Massachusetts Institute of Technology is to advance knowledge and educate students in science, technology, and other areas of scholarship that will best serve the nation and the world in the 21st century. Interactive stories, games and animations can be programed with Scratch. The workshop uses Scratch to implement a basic and widely known automatism, a traffic semaphore.

C. Driving lights with Crumble (20 minutes)

Crumble is an easy-to-use programmable controller. Its programming interface uses a block programming language which eases its use by children aged below 14. Educational robotics can be implemented easily with it due to the board connectors. Motors and servos can be managed by Crumble. Additionally, different sensors can be connected to it such as ultrasound distance sensor, infrared distance sensor and line detector sensor. Furthermore, Crumble can manage up to 32 RGB (Red, Green and Blue) LEDs (Light Emitter Diodes) independently and using 24 bits' color resolution. At this time, the traffic semaphore is implemented using Crumble.

D. Driving lights with Arduino (20 minutes)

Arduino was released by Massimo Banzi in

2005 as a modest tool for Banzi's students at the Interaction Design Institute Ivrea (IDII). Arduino is an open-source electronics platform based on easy-to-use hardware and software. It is a platform that incorporates a simple microcontroller and an interface development environment to create the applications to be downloaded into the board. The use of Arduino projects includes a wide range of applications from robotics to automatic control irrigation systems. Finally, the traffic semaphore is built in Arduino.

E. Discussion (15 minutes)

At this point, a discussion is opened with the aim of exchanging impressions and getting feedback from the attendees. The discussion is focused on how educational robotics can be good to motivate young students to basics disciplines, as mathematics and physics. The students think that these are too complicated and abstract disciplines, but with the applications in robotics, students can see how useful these disciplines can be.

II. Pre-knowledge of the attendees Previous experience in programming or robotics is not needed due to the nature of the used tools and the content

Pedro Plaza is with Plaza Robotica as Educational Content Designer.

Aruquia Peixoto is with CEFET/RJ (Centro Federal de Educação Tecnológica Celso Suckow da Fonseca) as Assistant Professor.

Driving lights through robotic educational

Authors: Plaza, Pedro; Sancristobal, Elio; Carro, German; Castro, Manuel; Blazquez, Manuel; Peixoto, Aruquia

Organisations: *PLAZA ROBOTICA, Spain; UNED, Spain; CEFET/RJ, Brazil*

Robotics and computational thinking are ideal tools for developing STEM (Science, Technology, Engineering and Mathematics) pedagogy. Nowadays, robotic education tools arise with the aim of promoting the innovation and the motivation of the students during the learning process. Robots are becoming more common in our daily life; thus, it is important to integrate robots at all levels of our society. This workshop is focused on driving the same content across three different low-cost robotic educational tools. The first one is Scratch, interactive stories, games and animations can be programed. The second tool is Crumble, it is an easy-to-use programmable controller. Its programming interface uses a block programming language which eases its use by children aged below 14. The last but not the least is Arduino, it Arduino is an open-source electronics platform based on easy-to-use hardware and software. It is a platform that incorporates a simple microcontroller and an interface development environment to create the applications to be downloaded into the board. This workshop is aimed to present the mentioned platforms as robotic educational tools for people as the first step to get into robotics world. Throughout this workshop an initiation to robotics is developed in the context of educational robotics.

(WS4) Workshop: A Practical Approach for Teaching Model Driven Software Development – A pleading for the "from scratch Approach"

Chairs: Schneider, Andreas

Room: 50 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-17 15:00

A didactic approach into teaching modeldriven software development (MDSD) is proposed in this workshop. The main idea is to focus on conveying underlying concepts, rather than managing a concrete tool or presenting a purely theoretical approach, when teaching MDSD. This objective shall be reached by the development of a simple code generator by the students, instead of using a concrete tool like Eclipse-EMF or Rational Rhapsody.

For this reason the whole process from graphical modeling to the actual code generation is traversed twice. In the first stage, the process is started at the back end (code generation), and worked successively to the front end. This way, the students see the result at the beginning (the source code generated) and can easily derive the necessity and capability of the upstream components. This derivation of requirements for upstream components is achieved by extending the initial task covering code generation. At the end of the first stage, a complete execution chain exists from modeling with an external UML modeling tool to several transformation steps, to the generation and formatting of the source code. The second stage is aimed at extending the code generator with additional capabilities, such as inheritance or supporting other UML diagram types, such as state transition diagrams. Contrary to the first stage, it proceeds in the other direction. In other words, the extensions are made starting from the output of the UML modeling tool to the meta-model, to code generation by templates.

An important point is the selection of appropriate tools, languages and technologies to build the generator. It became apparent, that this is a key point for the success of the course. Choosing a mixture of a script language, a template mechanism, XML-technologies, shell commands, and a small self-written library, the effort for the implementation of the generator could be reduced considerable, which allows the student to quickly implement the generator concepts.

Agenda:

Code generator types

Selection of Tools and Technologies

Programming Languages

Template Engine

Modeling Tool (UML-based)

Process Workflow

Model & Meta-Model

Model representation

Model Transformation & Verification

Initial functionality of the generator and possible extensions

Possible exercises

Prof. Dr. Andreas Schmidt is a professor at the Department of Computer Science and Business Information Systems of the Karlsruhe University of Applied Sciences (Germany). He is lecturing in the fields of database information systems, Big Data, data analytics and modeldriven software development. Additionally, he is a senior research fellow in computer science at the Institute for Applied Computer Science of the Karlsruhe Institute of Technology (KIT). His research focuses on database technology, knowledge extraction from unstructured data/text, Big Data, and generative programming. Dr. Schmidt has numerous publications in the field of database technology and information extraction. He regularly gives tutorials on international conferences in the field of Big Data related topics and model driven software development. Prof. Schmidt followed sabbatical invitations from renowned institutions like the Systems-Group at ETH-Zurich in Switzerland and the Database Group at the Max-Planck-Institute for Informatics in Saarbrucken/Germany.

A Practical Approach for Teaching Model Driven Software Development – A pleading for the "from scratch Approach"

Authors: Schmidt, Andreas

Organisations: University of Applied Sciences, Germany; Karlsruhe Institute of Technology

A didactic approach into teaching modeldriven software development (MDSD) is proposed in this workshop. The main idea is to focus on conveying underlying concepts, rather than managing a concrete tool or presenting a purely theoretical approach, when teaching MDSD. This objective shall be reached by the development of a simple code generator by the students, instead of using a concrete tool like Eclipse-EMF or Rational Rhapsody.

For this reason the whole process from graphical modelling to the actual code generation is traversed twice. In the first phase, a simple generator with minimum functionality, but a maximum number of relevant concepts will be implemented, starting from back to front to introduce the main concepts of a code generator engine and in a second phase from the beginning to extend the generator by additional functionality.

(WS5) Workshop: Designing and Conducting Jupyter Notebook Competitions

Chairs: Boesch, Chris

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-17 15:00

We have held numerous coding competitions in where students race to solve a series of coding problems. The winners of these competitions have been awarded portable computers, Pads, and other prizes donated by local sponsors. These competitions have been extended to support features such as automated mentor assignment where participants are assigned another participant to mentor as soon asthey have solved all their own problems. This mentor assignment has been shown to reduce the completion times between the 25th and 75th percentile participants while not negatively impacting the ability to identify the top three to five participants who might be eligible for prizes. More recently, these vents have been extended to support the Jupyter notebook environment used in many MOOCs and by different university programs ranging from psychology to economics to engineering. In these Jupyter notebookbased competitions, students solve problems in a Jupyter notebook environment similar to whatthey are likely to see in university assignments. These Jupyter notebooks also allow instructions, pictures, diagrams, and animations to be included with problems. In this workshop, we will work through the steps required to create and conduct a Jupyter notebook-based competition and how these competitions can be incorporated into live classroom sessions to enhance discussion, collaboration, and mentorship.

Designing and Conducting Jupyter Notebook Competitions

Authors: Boesch, Chris

Organisations: National University of Singapore

We have held numerous coding competitions in where students race to solve a series of coding problems. The winners of these competitions have been awarded portable computers, Pads, and other prizes donated by local sponsors. These competitions have been extended to support features such as automated mentor assignment where participants are assigned another participant to mentor as soon as they have solved all their own problems. This mentor assignment has been shown to reduce the completion times between the 25th and 75th percentile participants while not negatively impacting the ability to identify the top three to five participants who might be eligible for prizes. More recently, these events have been extended to support the Jupyter notebook environment used in many MOOCs and by different university programs ranging from psychology to economics to engineering. In these Jupyter notebook-based competitions, students solve problems in a Jupyter notebook environment

similar to what they are likely to see in university assignments. These Jupyter notebooks also allow instructions, pictures, diagrams, and animations to be included with problems.

In this workshop, we will work through the steps required to create and conduct a Jupyter notebook-based competition and how these competitions can be incorporated into live classroom sessions to enhance discussion, collaboration, and mentorship.

(WSIN-1) Industry Workshop -How to Design and Implement an Internet of Things Node in 90 Minutes (or less)

Chairs: Kane, Patrick

Room: 60 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-17 15:00

By 2020 there will be 50 Billion devices connected to the internet (MIT, 2017). More and more institutions are implementing IoT courses as part of their curriculum (Class Central, 2017; MIT, 2017; UC San Diego, 2017).

The proposed workshop will introduce attendees to available development kits suitable for education and will include a hands-on lab to create and program a BLE enabled development kit thus creating a simple IoT node.

This workshop present a hands-on workshop in which attendees create their own IoT node using the CY8CKIT-145 development board with BLE and the PSoC Creator IDE.

In addition to the above, this instructor-led workshop will include a high-level overview of the Bluetooth Low Energy (BLE) stack, and walk the attendees through the creation of a BLE application that can communicate with Apple or Android smart phones and tablets. Actual or Anticipated Outcomes: Each attendee will receive a BLE enabled development kit and software IDE and will leave the workshop with a working BLE application.

Background Knowledge: No specialized knowledge is required, however knowledge of embedded system design, IoT, and design IDE is a plus. Attendees should have a Windows 7 or better laptop. (MACs with VMWare etc. will also work).

Cypress University Alliance:

http://www.cypress.com/cua

Patrick Kane is the director of the Cypress University Alliance Program (CUA) at Cypress Semiconductor Corporation. The Cypress University Alliance Program is dedicated to partnering with academia to ensure that professors and students have access to the latest Cypress technology for use in education and research. Mr. Kane joined Cypress to create a university program at in July 2006. Before joining Cypress, Mr. Kane spent over 13 years at Xilinx in a variety of technical and marketing roles including Applications Engineering, Aerospace, High Reliability, Automotive, Technical Training Manager, and managed the Xilinx University Program (XUP) from 1998 through 2002. Prior to Xilinx, Mr. Kane spent a number of years at Advanced Micro Devices and Lattice Semiconductor Inc. He holds ASEET, BSEE, and MBA degrees and has authored numerous articles and conference papers. Mr. Kane is currently pursuing a doctorate in educational technology.

(WS1B) Workshop: Using the Up to University Platform on the Education

Chairs: Grammatikou, Mary; Szegedi, Peter

Room: 50 people, theater style, 3 people presidency table, video projector and computer, area mezzanine up of the conference center

Date and time: 2018-04-17 16:30

Up2U workshop will make the audience familiar with an advanced digital platform that has been developed in Up2U project (https://up2university.eu/). Up2U project's goal is to bridge the gap between secondary schools and higher education & research by better integrating formal and informal learning scenarios and adapting both the technology and the methodology that students will most likely be facing in universities. Up2U is designing, developing and deploying a Next Generation Digital Learning Environment - NGDLE with existing components, where possible using open source software, that are glued together in a specific way. In contrast with the market leaders who obviously put their particular products in the centre of their universe, Up2U is putting the emphasis on interoperability, modularity and portability.

To provide the LMS component of the Up2U prototype, the Moodle platform was selected, as a very widely used and supported LMS, of which multiple partners in the project have experience. As well as good support for interoperability standards such as LTI and xAPI, Moodle has an extensive set of available core and third-party plugins which enable the user experience on both desktop and mobile devices to be customised and extended with a wide variety of features, giving us future scope to tailor what users see according to the learning scenarios we intend to cover. The tools that are currently integrated and they will be also demonstrated in the workshop are: Moodle (LMS), ownCloud (Doc Sharing), eduOER (Content Repository), PuMuKIT (Video Platform), Learning Locker (LRS), SeLCont (Synchronized eLearning Content ToolKit), Opencast (Educational Multimedia Content Management), (Recording), WebTUT (Tutoring Application), H5P (Content Creation and Sharing), Commonspaces (Common Spaces for collaborative learning).

The workshop will inform the community about what the Up2U platform offers to the education in high schools environment and will train them on the Up2U modular platform. The full functionality of the platform will be demonstrated during the workshop and a "hands on experience" will be available for an in depth platform understanding. The teachers will have the opportunity to work with the platform and to make their own experience with the different tools of the Up2U architecture. A user guide will be available to the audience for a better understating of the platform functionality. This will be a real experience, of using the Up2U platform.

Peter Szegedi (male) has a background in the telecommunications industry and lately he joined the leading ICT and networking organization of the public research and education sector GÉANT (formerly known as TERENA). GÉANT is a fundamental element of Europe's e-infrastructure, delivering the pan-European GÉANT network for scientific excellence, research, education and innovation. Peter is the member of the Chief Community Support Office where he develops and manages the task forces, special interest groups and contributes to technical projects and strategic programmes, such as the Up to University (Up2U) Project. As the Senior Cloud Services Manager, he contributes to policy definition and implementation of the GÉANT Community Programme in the area of clouds and educational services support.

Dr. Mary Grammatikou (female) – is a Senior Researcher at the NETMODE laboratory of NTUA and Teaching Fellow at the School of Electrical & Computer Engineering of NTUA. She obtained her Diploma and the PhD degree in Electrical and Computer Engineering, both from NTUA. Her main research interests lie in the areas of service management, SDN technologies and NFV architectures, security, network virtualisation, e-service architectures and cloud computing, while she has been involved in various relevant RTD projects (e.g. NOVI, Fed4FIRE, EFIPSANS, OpenLab, GN3, GN3PLUS, GN4). She has She has an extensive experience in software systems design & development and she has participated in many European projects. She has been member of

the Technical Program Committees (TPCs) in several International Conferences (e.g. IEEE MENs, GlobeCom, CloudCom, SAM). She is a member of IEEE, TEE, WG7/TC48 Working Group and also of OGF, TM and DMT Forums.

(WS7) Workshop: Inclusion and integration of students with robotics

Chairs: Peixoto, Aruquia; Plaza Merino, Pedro

Room: 50 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-17 16:30

Robotics and computational thinking are ideal tools for developing STEM (Science, Technology, Engineering and Mathematics) pedagogy. Nowadays, robotic education tools arise with the aim of promoting the innovation and the motivation of the students during the learning process. Robots are becoming more common in our daily life; thus, it is important to integrate robots at all levels of our society. This workshop is focused on presenting Raspberry Pi as enhancer of educational robotics. The first step is presenting robotics as a tool for promoting the inclusion and integration of students. A Workshop background and overview is also provided. The third part propose different setups to prepare a Raspberry Pi for remote activities and robotics using Arduino as hardware interface. The last but not the least is an open discussion with the aim of exchanging impressions and getting feedback from the attendees.

This workshop is intended to be deployed for 90 minutes. The agenda is divided in four main blocks. The first block is intended to introduce STEM pedagogy and robotics education as the underlying background of this workshop. Furthermore, an overview of the workshop is provided too. In a second step, the Raspberry Pi tool is presented, and the content is deployed based on Raspberry Pi. In this step robotics is also presented as a tool to promote the inclusion and integration of students. Finally, some time is reserved to discuss about the content and the experiences.

Pedro Plaza is with Plaza Robotica as Educational Content Designer.

Aruquia Peixoto is with CEFET/RJ (Centro Federal de Educação Tecnológica Celso Suckow da Fonseca) as Assistant Professor.

Inclusion and integration of students with robotics

Authors: Peixoto, Aruquia; Plaza, Pedro; Castro, Manuel; Blazquez, Manuel; Martín, Sergio; Sancristobal, Elio; Carro, German

Organisations: *CEFET/RJ*, *Brazil; PLAZA ROBOTICA*, *Spain; UNED*, *Spain*

Robotics and computational thinking are ideal tools for developing STEM (Science, Technology, Engineering and Mathematics) pedagogy. Nowadays, robotic education tools arise with the aim of promoting the innovation and the motivation of the students during the learning process. Robots are becoming more common in our daily life; thus, it is important to integrate robots at all levels of our society. This workshop is focused on presenting Raspberry Pi as enhancer of educational robotics. The first step is presenting robotics as a tool for promoting the inclusion and integration of students. A Workshop background and overview is also provided. The third part proposed different setups to prepare a Raspberry Pi for remote activities and robotics using Arduino as hardware interface. The last but not the least is an open discussion with the aim of exchanging impressions and getting feedback from the attendees.

(WS8) Workshop: Evaluation of experimental activities

Chairs: Urbano, Diana; Restivo, Maria Teresa

Room: 60 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-17 16:30

Experimental training is recognized as a fundamental aspect of engineering education. While experimenting, students are following the "scientific method" and are able to verify theoretical models and learn how to analyze data. For more than 40 years now, computers and instrumentation have been playing an important part in simulation, in data collection and analyses and in the emergence of remote experimentation (RE). In RE physical experimental setups are controlled remotely and data can be automatically collected. More recently, emerging technologies such as virtual and augmented reality with haptic interaction and other sensorial devices are also being used in experimental activities in engineering education. All these resources together integrated in collaborative platforms constitute what is called Online Experimentation (OE).OE, in general, still raises a lot of concerns among science and engineering educators since they are not considered pedagogically as effective as hands-on experimentation. This has been the main trigger of the evaluation of the use OE resources.

The main purpose of this workshop is to show how to evaluate conceptual knowledge gain and students' reaction to the experimental activities, using both hands-on and OE examples. The evaluation of knowledge gain is performed using the pre- and post- tests methodology, where a normalized gain is calculated. Students' reaction is assessed through descriptive statistics analysis of the results of questionnaires. When the number of students is big enough a Structural Equation Model analysis of the results of the questionnaires can becomducted allowing for testing effects of cognitive factors, like Ease of Use and Perceived Value on affective and behavioral factors like Attitude and Behavioral Intention. The pedagogical strategy for these evaluations will be introduced by allowing the participants of the workshop to go through the same processes as students, while experimenting in hands-on activities or activities involving haptic devices interacting with virtual replicas or augmented reality applications. The analysis of the evaluation data will be shown with examples from different experimental activities either of hands-on or OE types.

Evaluation of experimental activities

Authors: Urbano, Diana; Restivo, Teresa

Organisations: University of Porto, Portugal, Portugal

Experimental training is recognized as a fundamental aspect of engineering education. While experimenting, students are following the "scientific method" and are able to verify theoretical models and learn how to analyze data. For more than 40 years now, computers and instrumentation have been playing an important part in simulation, in data collection and analyses and in the emergence of remote experimentation (RE). In RE physical experimental setups are controlled remotely and data can be automatically collected. More recently, emerging technologies such as virtual and augmented reality with haptic interaction and other sensorial devices are also being used in experimental activities in engineering education. All these resources together integrated in collaborative platforms constitute what is called Online Experimentation (OE).

(WSIN-2) Industry Workshop - Autograding MATLAB Code - Getting Started with Cody Coursework

Chairs: Gross, Sebastian

Room: 340 people plenary room with speaker and presidency table located in the basement at the right of the reception

Date and time: 2018-04-17 16:30

A brief workshop on creating MATLABbased course assignments for autograding with Cody Coursework

Sebastian Gross studied Electrical Engineering at RWTH Aachen university and received his diploma in 2007. Subsequently, he worked as a scientific researcher and teaching assistant at the same institution and received his PhD in Medical Image Processing in 2014. In 2013, he joined the MathWorks in Munich where he is currently a Senior Customer Success Engineer collaborating with academic customers in education and research projects. Furthermore, he runs workshops and seminars on teaching with MATLAB and Simulink and is involved in preuniversity STEM education activities.

(WSIN-3) Industry Workshop:

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-17 16:30

Blackboard Ally and ReadSpeaker are working to help instructors worldwide improve the accessibility of course content for their students.

Accessibility to elearning content is a legal and moral requirement for many institutions, but most of them have focused on adaptation of phisical spaces.

Content accessibility not only helps students with special needs. Every learner has favored methods for obtaining, comprehending, and retaining information. As part of Universal Design for Learning, it aims to help the maximum number of learners comprehend and retain information by appealing to all learning styles.

Both Blackboard Ally and ReadSpeaker integrate with an institution's existing LMS: they complement each other to improve accessibility content, identifying common accessibility issues within course materials and generating a range of more accessible alternatives of the instructor's original content.

Javier Gregori, Senior Manager, Solution Engineering-EMEA SOUTH, is a technology and education enthusiast. Doctorate in Education Sciences by the UEX, he developed his dissertation in the field of the instructors' digital skills in charge of the training for employment in the construction sector. GMBA degree by the IE (Instituto de Empresa), has held senior positions associated to leadership in educational innovation. Javier has participated in multiple national and european projects working in a lot of different fields related to technology and innovation like contents to digital formation, augmented reality or simulation software for vehicles and machinery.

Antonino Sistac is Industrial Engineer (University of Zaragoza and TU Braunschweig, Germany) and holds an MBA from INSEAD. He has managed technology and innovation projects across a wide array of industries: automotive, telecom, utilities and education. He helped launched ReadSpeaker in Spain in 2005, and has been working to make the company a global player in the text-to-speech arena. He is an accessibility evangelist, and keeps on working to spread the notion that Universal Design and accessibility are important for all.

(WS9) Workshop: Development of Computing Competencies and the CC2020 Project

Chairs: Impagliazzo, John; Pears, Arnold Neville

Room: 340 people plenary room with speaker and presidency table located in the basement at the right of the reception

Date and time: 2018-04-19 08:30

Participants attending this conference workshop will contribute to the development of the Computing Curricula 2020 (CC2020) project and help to formulate sets of disciplinary relevant competencies in the context of comput-Through the workshop activities, paring. ticipants will engage in brainstorming activities to formulate competencies relative to the CC2020 project, an endeavor supported by the Association for Computing Machinery (ACM) and the IEEE Computer Society. The interaction among workshop purveyors and participants will draw upon a pioneering curricular document for information technology (IT2017), curricular competency frameworks, and other related documents such as the software engineering competency model (SWECOM). The workshop objective is to ensure that the new CC2020 report provides forward-looking summaries of educational outcomes formulated in terms of functional competencies in computing fields within the international context of computing education on a global scale. Although the CC2020 project has overarching purposes, workshop participants will focus on competencies related to the CC2020 project.

John Impagliazzo (Hofstra University) is a member of the steering committee of the CC2020 project. He was chair of the steering committee that produced the computer engineering curricular report (CE2016) and was a principal co-author of the committee that produced the CE2004 [6] report. He was an active member of the CC2005 project, allowing him to be a valued contributor to the CC2020 project. He is also a member of the committee of a parallel project for information technology (IT2017). John is an IEEE Fellow, an IEEE Life Member, a CSAB Fellow, and an ACM Distinguished Educator. He is a moderator of the workshop and will present a brief overview and evolution of the CC2005 document and explain the role of competencies in computing.

Arnold Neville Pears (Uppsala University, KTH Royal Institute of Technology, Sweden) is a member of the steering committee of the CC2020 project. He has extensive curriculum development experience, has served on the Board of Governors of the IEEE Computer Society (2012-2014), and is director-elect to the Board of Governors of the IEEE Education Society (2018-2020). He currently has a dual appointment between Uppsala and KTH universities as Professor of Computer Science in Computing Education Research and as Professor of Engineering Education, respectively.

Development of Computing Competencies and the CC2020 Project

Authors: Impagliazzo, John; Pears, Arnold Neville

Organisations: Hofstra University, United States of America; Uppsala University, Sweden

Participants attending this conference workshop will contribute to the development of the Computing Curricula 2020 (CC2020) project and help to formulate sets of disciplinary relevant competencies in the context of comput-Through the workshop activities, paring. ticipants will engage in brainstorming activities to formulate competencies relative to the CC2020 project, an endeavor supported by the Association for Computing Machinery (ACM) and the IEEE Computer Society. The interaction among workshop purveyors and participants will draw upon a pioneering curricular document for information technology (IT2017), curricular competency frameworks, and other related documents such as the software engineering competency model (SWECOM). The

workshop objective is to ensure that the new CC2020 report provides forward-looking summaries of educational outcomes formulated in terms of functional competencies in computing fields within the international context of computing education on a global scale. Although the CC2020 project has overarching purposes, workshop participants will focus on competencies related to the CC2020 project.

(WS10A) Workshop: Publishing Your Scholarship in the IEEE Transactions on Education (Part 1)

Chairs: Froyd, Jeffrey

Room: 340 people plenary room with speaker and presidency table located in the basement at the right of the reception

Date and time: 2018-04-19 15:00

Scholarship in engineering education is shifting and authors seeking to publish their work in engineering education must be prepared to address changing expectations for scholarship. The workshop first introduces expectations for scholarship in a developing field. Second, the session presents the threeareas of scholarship proposed by Ernest Boyer and session participants learn characteristics of manuscripts appropriate for each area of scholarship:

Scholarship of Discovery

Scholarship of Application

Scholarship of Integration.

Third, session participants in the workshop will explore how to address review criteria for each area of scholarship, e.g., relevance, intended outcomes, application/instructional design, and findings. Analysis of manuscripts submitted to the IEEE Transactions on Education over the past 30 months suggest thatauthors struggle with how to address these review criteria. The intent of the workshop is to help authors and potential authors prepare manuscripts that address the expectations for publishing scholarship in engineering education in the IEEE Transactions on Education.

Introduce Fensham's (2004) Criteria for Defining the Field of Science Education Research

Introduce Boyer's (1992) Areas of Scholarship

Scholarship of Discovery

Scholarship of Application

Scholarship of Integration

Activity: Ask Participants to Select an Appropriate Area of Scholarship for an Abstract of a Paper

Introduce Review Criteria for the Three Areas of Scholarship

Scholarship of Discovery

Scholarship of Application

Scholarship of Integration

Describe Review Criteria that Need More Elaborate Descriptions

Findings

Application Design

Intended Outcomes

Context

Jeffrey E. Froyd is a Professor in the Department of Engineering Education in the College of Engineering at The Ohio State University. He served as Project Director for the Foundation Coalition, an NSF Engineering Education Coalition in which six institutions systematically renewed, assessed, and institutionalized integrated undergraduate engineering curricula, and shared their results with the engineering education community. He co-created the Integrated, First-Year Curriculum in Science, Engineering and Mathematics at Rose-Hulman Institute of Technology, which was recognized in 1997 with a Hesburgh Award Certificate of Excellence. He has authored or coauthored over 70 papers onengineering education in areas including change in STEM education, faculty development, and curricular innovation. He is currently the Editor-in-Chief for the IEEE Transactions on Education, a Senior Associate Editor for the Journal on Engineering Education, an associate editor for the International Journal on STEM Education, an ABET EAC Commissioner, an IEEE Fellow, and an ASEE Fellow.

Publishing Your Scholarship in the IEEE Transactions on Education (Parts 1 and 2)

Authors: Froyd, Jeffrey

Organisations: Ohio State University, United States of America

Scholarship in engineering education is shifting and authors seeking to publish their work in engineering education must be prepared to address changing expectations for scholarship. The workshop first introduces expectations for scholarship in a developing field. Second, the session presents the three areas of scholarship proposed by Ernest Boyer and session participants learn characteristics of manuscripts appropriate for each area of scholarship:

- Scholarship of Discovery
- Scholarship of Application
- Scholarship of Integration.

Third, session participants in the workshop will explore how to address review criteria for each area of scholarship, e.g., relevance, intended outcomes, application/instructional design, and findings. Analysis of manuscripts submitted to the IEEE Transactions on Education over the past 30 months suggest that authors struggle with how to address these review criteria. The intent of the workshop is to help authors and potential authors prepare manuscripts that address the expectations for publishing scholarship in engineering education in the IEEE Transactions on Education.

(WS10B) Workshop: Publishing Your Scholarship in the IEEE Transactions on Education (Part 2)

Chairs: Froyd, Jeffrey

Room: 340 people plenary room with speaker and presidency table located in the basement at the right of the reception

Date and time: 2018-04-19 16:30

Scholarship in engineering education is shifting and authors seeking to publish their work in engineering education must be prepared to address changing expectations for scholarship. The workshop first introduces expectations for scholarship in a developing field. Second, the session presents the threeareas of scholarship proposed by Ernest Boyer and session participants learn characteristics of manuscripts appropriate for each area of scholarship:

Scholarship of Discovery

Scholarship of Application

Scholarship of Integration.

Third, session participants in the workshop will explore how to address review criteria for each area of scholarship, e.g., relevance, intended outcomes, application/instructional design, and findings. Analysis of manuscripts submitted to the IEEE Transactions on Education over the past 30 months suggest thatauthors struggle with how to address these review criteria. The intent of the workshop is to help authors and potential authors prepare manuscripts that address the expectations for publishing scholarship in engineering education in the IEEE Transactions on Education.

Introduce Fensham's (2004) Criteria for Defining the Field of Science Education Research

Introduce Boyer's (1992) Areas of Scholarship

Scholarship of Discovery

Scholarship of Application

Scholarship of Integration

Activity: Ask Participants to Select an Appropriate Area of Scholarship for an Abstract of a Paper

Introduce Review Criteria for the Three Areas of Scholarship

Scholarship of Discovery

Scholarship of Application

Scholarship of Integration

Describe Review Criteria that Need More Elaborate Descriptions

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Jeffrey E. Froyd is a Professor in the Department of Engineering Education in the College of Engineering at The Ohio State University. He served as Project Director for the Foundation Coalition, an NSF Engineering Education Coalition in which six institutions systematically renewed, assessed, and institutionalized integrated undergraduate engineering curricula, and shared their results with the engineering education community. He co-created the Integrated, First-Year Curriculum in Science, Engineering and Mathematics at Rose-Hulman Institute of Technology, which was recognized in 1997 with a Hesburgh Award Certificate of Excellence. He has authored or coauthored over 70 papers onengineering education in areas including change in STEM education, faculty development, and curricular innovation. He is currently the Editor-in-Chief for the IEEE Transactions on Education, a Senior Associate Editor for the Journal on Engineering Education, an associate editor for the International Journal on STEM Education, an ABET EAC Commissioner, an IEEE Fellow, and an ASEE Fellow.

Sessions

(1A) Collaborative work and Technologies for Engineering Education

Chairs: Auer, Michael

Room: 50 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-18 10:30

Immersive Peer Education: Virtual Interactive Scalable Online Notebooks for Science (VISONS)

Authors: Neustock, Lars Thorben; Herring, George K.; Hesselink, Lambertus

Organisations: Stanford University, United States of America

Educating peers and broader audiences is of great significance within the scientific community. The education process aids the communication of ideas and allows for engagement with science. We present a ready-to-use tool to exchange data collected in laboratories in a scalable, graphical and easily accessible manner using Massively Scalable Online Laboratories (MSOL) embedded within Virtual Interactive Scalable Online Notebooks for Science (VISONS). The tool we present replicates the experiment in a visual and interactive way, dynamically displaying the experiment in all of its states. Using VISONS, researchers can more easily engage in discussions about their experimental results, which allows for a deeper understanding of their data and scientific challenges. The form of data exchange and graphic interface we present here helps to stimulate purposeful conversations about cutting-edge science by using VISONS during discussions with peers or in publications. Moreover, our approach, which uses efficient data storage and retrieval capabilities, provides scalable data

management that laboratory environments currently lack. Simultaneously, we provide a more effective way for researchers manage their own work. VISONS offer a clear and concise version control system, assisting scientists at all stages of the development process. To provide information security during preliminary experimental work, before official publications, we incorporated a feature to choose the target audience for each experiment. To demonstrate the merits of VISONS, we recorded different versions of a cutting-edge science experiment, a quantum-noise limited differential phase contrast X-Ray imaging system, during its development process.

Benefits and drawbacks of source code plagiarism detection in engineering education

Authors: Pawelczak, Dieter

Organisations: UniBw Munich, Germany

Source code plagiarism is wide spread in beginners' programming courses. Especially, if programming is a minor subject, as for instance in engineering degrees. It is very tempting for students during a programming assignment to use a working copy of a fellow student rather than struggling with the time-consuming coding by themselves. But as learning programming requires a significant personal commitment, we confirm the results of other studies, that cheating leads to higher failure rates and lower scores in the examination. Automatic plagiarism detection systems are therefore measures against cheating. We analyzed the students' achievements and opinions during the last 5 years of operating an automated assessment system with plagiarism detection. The paper discusses in detail the benefits of such a system, e.g. the equal treatment of all students compared to manual plagiarism checks, and shows also the disadvantages, e.g. code obfuscation, that students perform in order to circumvent the system.

Forming and transforming STEM teacher education

Authors: Francis, Krista; Alonso Yáñez, Gabriela; Chapman, Olive; Cherkowski, Gina; Dodsworth, Dianne; Friesen, Sharon; Gereluk, Dianne; Knowlton Cockett, Polly; Preciado Babb, Armando Paulino; Shanahan, Marie-Claire; Takeuchi, Miwa; Thomas, Christy; Turner, Jeff

Organisations: University of Calgary, Canada

This paper discusses the ongoing processes and challenges for designing an introductory undergraduate STEM Education course, as informed by the perspectives of eleven instructors and two administrators that have taught the course repeated times, including its revisions and modifications. The course embraces a transdisciplinary approach where inquiry transcends each specific discipline. The intent of the course is to foster an understanding of how STEM can inform and be used to shape teaching and learning across grade levels and subject areas. After four years of multiple iterations, we consider our course to be an innovative cornerstone of the undergraduate education program. Our successes include a collaborative assessment process that strengthens our collective capacity and understanding of STEM education, facilitates consistent expectations and assessments across sections, and improves the quality of per-service teachers' assignments. Our challenge is to address differing attitudes and course evaluation scores between elementary and secondary pre-service teachers. Elementary pre-service teachers are more accepting and willing to learn about STEM education. Secondary pre-service teachers are more reluctant and resistant. Contesting their preconceived notions, identity, negative attitudes, and external structures of schooling is essential for improving secondary pre-service teacher responsiveness to STEM and trans-disciplinary pedagogic approaches.

The goal of a teaching methodology in higher education

Authors: Travassos Valdez, Manuel; Machado Ferreira, Carlos; Maciel Barbosa, Fernando

Organisations: Instituto Superior de Engenharia de Coimbra, Portugal; Faculdade de Engenharia da Universidade do Porto, Porto

Curricular policies and the processes of organization and development of a curriculum must include, in their objectives, reflections on the ways of responding to the demands of society.

The objective of a teaching/learning methodology is to support the teacher, so that a favourable situation is created for the enrichment of the class, for a better assimilation of the subject under discussion. A teaching/learning methodology is therefore a set of procedures that are designed to make changes.

From this point of view, it is also necessary for the students, the future qualified professionals, to master the indispensable knowledge about the issues and to reach an introspection that allows them to make the best decisions.

The basic principles underlying effective learning are: prior knowledge of students can help learning; the way students organize knowledge influences how they learn and apply what they know; motivation determines, directs, and supports what to do to learn; to develop competence, students must acquire skills, acquire practice in integrating them and know when to apply what they have learned; practice should be directed towards objectives along with feedback, increasing the quality of learning; students should learn to control and adjust their approaches to learning.

Learning from the Unexpected: Statistics and Uncertainty in Massively Scalable Online Laboratories (MSOL)

Authors: Herring, George K.; Neustock, Lars Thorben; Hesselink, Lambertus

Organisations: Stanford University, United States of America

Reasoning about unexpected outcomes is crucial to scientific exploration and STEM education. To stimulate conversations about these outcomes, we integrated noise characteristics and uncertainty into the framework of Massively Scalable Online Laboratories (MSOLs), which provide a collaborative and interactive online environment for education. The MSOL approach reduces a physical experiment to a set of states and displays it in an interactive environment. With the approach described here, those stages exhibit noise characteristics and nondeterministic outcomes. As a demonstration, we successfully recorded and displayed an example experiment, which contains quantum noise and limited repeatability. We thus display experiments more realistically and lead students towards a deeper understanding of the physical reality by evoking their curiosity about the variation of the displayed outcomes.

Promoting Engineering Education by Scientific Research: Cultivating Creative Talents

Authors: Fan, Hua

Organisations: University of Electronic Science and Technology of China, China, People's Republic of

Currently, looking at the higher education, teaching and scientific research are the focus of the universities, but the phenomenon of emphasizing and centralized scientific research, marginalizing and underestimating teaching seems increasingly intensified. Most teachers are often busy with research, use old course content, lost touch with engineering practice, pay no attention to discussion with students and the quality of teaching in classroom. In addition, teachers who are successful in classroom while unsuccessful in academia are numerous.

Teaching and research group of "fundamentals of analog circuits" is engaged in teaching basic courses, but the group never neglected scientific research of teachers, guiding the combination of scientific research and engineering education curriculum to ensure the advanced and practical content of course and form a pattern of teaching driven by scientific research. A high level of scientific research not only broadens the horizons of teachers and enable the teachers to deepen the understanding and application of the content, but also creates a good space and the environment to cultivate innovative talents by introducing mature scientific research in engineering practice, setting up innovation experiments, highlighting the practical ability.

In this work, detailed examples of individual innovative experiments derived from scientific research are given, a virtuous cycle between engineering education and scientific research has been formed to stimulate the interest and motivation of students.

In August, 2016, the first author participated in the young teachers teaching competition organized by the Ministry of Education, during the competition, with the novel teaching method which combines the "fundamentals of analog circuits" and scientific research flexibly, the first author won the second prize in the southwest of China.

(1B) Semantic Web and Ontologies for Learning Systems

Chairs: REYMOND, David

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-18 10:30

Application of ontologies in higher education: A systematic mapping

Authors: Tapia-Leon, Mariela; Carrera Rivera, Abdon; Chicaiza Espinosa, Janneth; Luján-Mora, Sergio

Organisations: Universidad de Guayaquil, Ecuador; Universidad Técnica Particular de Loja, Ecuador; Universidad de Alicante

Universities and Higher educational institutes constantly create knowledge, hence it is necessary to keep record of the academic and administrative information generated. Considering the large amount of information managed by higher education institutions and the diversity of heterogeneous systems that can coexist within the same institution, it becomes necessary to use technologies for knowledge representation. Ontologies facilitate access to knowledge allowing the adequate exchange of information between people and between heterogeneous systems. This paper aims to identify existing research on the use of ontologies in higher education. By performing a systematic mapping study, approximately 50 research papers have been selected, reviewed and analyzed from an initial set of 2792 papers. Our results provide some findings regarding how ontologies are used in Higher Education Institutes, what technologies and tools are applied for the development of ontologies and what are the main vocabularies reused in the application of ontologies.

Keywords: Systematic mapping, Ontology, Higher Education, University

To context-aware learner modeling based on ontology

Authors: Akharraz, Laila; El mezouary, Ali; Mahani, Zouhir

Organisations: IRF-SIC Laboratory IBN ZOHR University B.P.28 / S - Agadir - Morocco; LASIME Laboratory IBN ZOHR University B.P.28 / S - Agadir - Morocco One of the main motivations for better learner modeling is to make distance learning system intelligent so that they can present adaptive learning content to each learner according to his needs. This aspect of intelligence is mainly ensured by the exploitation of the learner model. However, the multiplicity of information about the learner makes their modeling a very complex activity and constitutes an open line of research, which has given rise to several proposals from different points of view. In this trend, this paper presents a new learner modeling approach sensitive to the context enriched from existing models and based on the exploitation of ontology.

General Learner Model Ontology for Adaptive Lifelong Learning

Authors: Nurjanah, Dade

Organisations: Telkom University, Indonesia

This paper discusses our research on user model ontology for lifelong learning. The research questions addressed in this paper are what information about learners can make learning be adaptive, how the representation of lifelong user model ontology, and how to extract the general user model to be used in and updated by a certain adaptive learning system. The goal expected to be achieved is that there is an open lifelong learner model ontology to be accessed and updated by adaptive learning systems. Some information of ontology should be able to be extracted based on the needs of adaptive learning system and vice versa, as well as the elements of ontology must be able to be updated by adaptive learning system. The ontology extraction test was conducted by extracting the user model twice for two different adaptive learnings, then it was checked if the user model ontology resulted from the extraction was valid, meaning it still had constraints on the elements in accordance with the initial, and could be used for a certain targeted adaptive learning system. Then, updates were conducted on the ontology resulted from the extraction as a simulation of learner model update on learning activities in adaptive learning system. Furthermore, the updated ontology was recombined with the initial ontology. We tried it for AVANTI's and INTERBOOK's user models. The experiment show that the general user model ontology and its extraction and update functions can keep the ontology valid.

E-exams in Engineering Education – Online Testing of Engineering Competencies – Experiences and Lessons Learned

Authors: Feldmann, Nina; Boehmer, Cornelia; Ibsen, Michael

Organisations: Hochschule Aschaffenburg, Germany; Xisio Informationssysteme GmbH

Aschaffenburg University of Applied Sciences and Darmstadt University of Applied Sciences developed a blended-learning bachelor's program in electrical engineering und information technology for non-traditional students. It was enhanced with e-learning components in different study phases, e.g. self-study phase, phase of attendance and preparatory study phase [1]. To the end, lecturers developed concepts and appropriate e-learning content for their modules. After six years of producing a wide range of e-learning material, the development of eexams has to be the next step. The necessity of offering online-examination is especially important for a blended-learning studying program since non-traditional students do not have to travel to the place of study for only one or two exam/s per day. [2] The idea of developing 'e-exams from at home' "sprouted" and the first step was the consideration how this kind of exam put into practice. This paper describes the development process - from the initial ideas to the raised questions in connection with eexams.

Balancing Low-Level vs. High-Level Programming Knowledge in an Undergraduate Microprocessors Course

Authors: El-Abd, Mohammed

Organisations: American University of Kuwait, Kuwait

In this work, we address the issue of balancing low-level vs. high-level programming knowledge and experience in embedded systems courses. On one hand, low-level programming (i.e. Assembly) is important for the students to fully understand how the machine works and have full control over its different capabilities and hardware features. On the other hand, high-level programming experience (i.e. C/C++) is a must to cope with recent industrial and embedded market trends. We aim to investigate one teaching approach that could be used to adequately deliver both learning experiences in an undergraduate microprocessors course. Sample lab sheets and assignments that demonstrate the proposed approach are presented. The approach is tested over two consecutive semesters and both students' feedback and performance are used to

evaluate the proposed methodology.

Education Engineering in Spain: Seven years with the Bologna Process

Authors: Llamas Nistal, Martín; Mikic Fonte, Fernando A.; Caeiro Rodríguez, Manuel; Castro, Manuel; Tovar, Edmundo; Plaza, Inmaculada

Organisations: *IEEE-ES Spanish Chapter, University of Vigo, Spain; IEEE-ES Spanish Chapter, UNED, Spain; IEEE-ES Spanish Chapter, UPM, Spain; IEEE-ES Spanish Chapter, University of Zaragoza, Spain*

The year 2012, the IEEE-Education Society Spanish Chapter (SC) carried out a study about the state of the EHEA (Bologna Process) implementation in engineering degrees along Spain and the opinion of teachers about the main aspects of this implementation. Five years later, the SC is carrying out a similar study taking into account that the EHEA has been active at least for seven years. This study has two parts: the first one is focused on similar aspects (when possible) on the previous survey in order to enable an easy comparison with the previous survey. The second part focus on resources, methodologies and open-answer questions on the opinion of the teachers on the main aspects of the EHEA. In this paper, the survey is introduced and the results of the first part of this survey are presented, comparing with the results of the 2012 survey.

(1C) Learning Systems Platforms and Architectures

Chairs: Plaza Merino, Pedro

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-18 10:30

An integrated model for the continuous use intention of MS Office simulation software

Authors: Venter, Marisa Isabel; Swart, Arthur James

Organisations: Central University of Technology, South Africa

Web based training software has been used extensively as one of the instruction methods to train users in basic digital literacy skills. One such example is the simulated online learning environment. Due to the fact that students are able to interact with real time simulations, these environments are referred to as Interactive Online Learning Environments (IOLEs). At most universities in South Africa, students from all faculties are obligated to take an introductory digital literacy course during their first year of study. Due to the large numbers of students in these introductory courses, universities are predominantly making use of IOLEs to assist with the teaching and assessment of MS Office skills. Limited research has been conducted on the constructs that may contribute to the continuous use intention of MS Office IOLEs by students in higher education. The main objective of this paper is to propose a model for the continuous use intention of IOLEs. Three theoretical models were combined in order to develop this model, and include Flow Theory, Information System Expectation-Confirmation Model and the DeLone and McLean Information Systems Success Model. Results reveal that the following constructs should be included in the model to predict continuous use intention: satisfaction, perceived usefulness, perceived enjoyment, perceived ease of use and focused immersion. In addition, students' satisfaction toward MS Office IOLEs was determined by information quality, perceived usefulness and perceived enjoyment. Understanding the constructs that influence students continuous use towards MS Office IOLEs could be used by institutions, businesses and instructors to focus their efforts on improving specific aspects of these platforms that would lead to higher levels of student engagement with them. This, in turn, could lead to higher levels of academic success as students engage more with the course content and improve their MS Office skills, one of the most important skills required by all types of employers today.

Studio Teaching - An Embedded Systems Course

Authors: Manseur, Rachid

Organisations: SUNY Oswego, United States of America

Teaching microprocessors at the undergraduate level can be accomplished far more effectively when modern teaching techniques utilizing hands-on and project-based methods are implemented. This article presents an embedded systems course taught in a studio format that combines lecturing and laboratory experimentation to teach and train students in the direct application of microprocessor and microcontroller systems. Studio teaching is best conducted in facilities that are designed for that purpose. One of the main topics to be addressed in the development of a studio course is the selection of suitable experiments that support effective teaching of fundamental concepts through direct application of those concepts. This paper discusses several aspects of the course development and delivery including facilities, equipment, pedagogy, and example classwork

Personalization Criteria for enhancing learner engagement in MOOC platforms

Authors: Assami, Sara; Daoudi, Najima; Ajhoun, Rachida

Organisations: National high school of Computer science and System Analysis (ENSIAS), Morocco

The use of ICT (Information and Communication Technology) revolutionized the education sector with MOOCs (Massive Open Online Courses) becoming a major focus for open education actors and top universities to resolve the limited resources issue and make education accessible worldwide. Our study focuses on the problem of dropouts in MOOCs and how we can reduce the phenomenon by adapting learning according to criteria that enhance MOOC learners' motivation. It relies on enhancing the recommendation process of Courses according to the learner personal expectations, preferences and cognitive learning style among other personalization criteria. Furthermore, it suggests a new approach to profile construction for a MOOC recommendation system by considering external data to define a learner's interests.

Pictogramming - Programming Learning Environment using Human Pictogram –

Authors: Ito, Kazunari

Organisations: Aoyama Gakuin University, Japan

In this study, we propose a new programming learning environment called "Pictogramming." Pictogramming is based on two words: "pictogram" and "programming." The basis of this application is the use of a human-shaped pictogram (i.e., a "human pictogram"). Pictograms resemble a person or object with an abstract representation. Human pictograms are associated with syntonic learning and visual manifestation. The proposed application can display a human pictogram in the front and side directions defined by ISO (International Organization for Standardization), where both comprise nine body parts. The application moves the parts using a command sequence called the "Pictogram Animation Command." The application can draw the movement history (similar to turtle graphics) as "Pictogram graphics." The combination of both functions facilitates learning in small steps over a short period of time using a small command set. We evaluated the effectiveness of this application with approximately 100 junior high school students. The results were generally favorable but it is necessary to improve the content and the method for learning conditional branching.

Structured MOOC designed to optimize Electricity learning at Secondary School

Authors: Blazquez-Merino, Manuel P.; Macho Aroca, Alejandro; Baizan Alvarez, Pablo; Garcia Loro, Felix; San Cristobal, Elio; Diez Orueta, Gabriel; Castro, Manuel

Organisations: UNED - Spanish Open University, Spain

A massive open online course is presented addressed to Secondary students in their first years in order to introduce electricity concepts and magnitudes. The MOOC has been designed via a Bloom-Anderson's taxonomy approach to maximize cognitive skills of students when facing electrical concepts for the first time. Throughout the course, specific activities have been designed and ordered to optimize learning, distinguishing those to consolidate low order thinking skills (LOTS) from those to develop high order thinking skills (HOTS).

The course has been designed using Moodle and incorporates documentation divided in three chapters, each of them containing six stages according to LOTS-HOTS scheme. Several videos have been recorded and located in the course to be displayed in specific moments of the course to help to students to understand the purpose of the course as well as to assist in the use of VISIR remote laboratory. VISIR, thus, has been selected as the technical resource to make the electrical practices included in the MOOC.

In the full version of the paper, a detailed description of the MOOC is provided as well as the specific means of assessment designed to evaluate knowledge acquisition of students.

Systematic Evolution of a Learning Setting for Requirements Engineering Education based on Competence-Oriented Didactics

Authors: Sedelmaier, Yvonne; Landes, Dieter

Organisations: Coburg University of Applied Sciences and Arts, Germany

It is widely agreed that requirements engineering is a top success factor for IT (and non-IT) projects. Qualified requirements engineers need to possess not just factual knowledge, but also many skills. Yet, it is an open question which competencies requirements engineers actually need, and how these competencies may be addressed appropriately in education. As a methodological framework, we devised an approach, Competence-Oriented Didactics, which rests on a sound pedagogical underpinning.

This paper shows how Competence-Oriented Didactics is applied to a requirements engineering course. In contrast to more traditional teaching approaches, students shall not only acquire technical requirements engineering knowledge, but, at the same time, develop non-technical competencies that are necessary for requirements engineering. In particular, students shall better understand why requirements engineering and several of its core methods, techniques, and skills are needed. Moreover, students shall develop and expand the necessary skills for requirements engineering. Consequently, learning shifted from an instructive to an active and inductive style, which builds on exercises that make students actively discover relevant requirements engineering issues and gain hands-on experiences. Results from systematic evaluations indicate that the described didactical settings works well.

This paper has two main contributions: first, a systematic, competence-driven approach to develop learning settings, and second, a learning setting that is equally directed towards technical and non-technical competencies of requirements engineers and demonstrably achieves its goals.

(1D) $\mathbf{E} \cdot \mathbf{Assessment}$ and new Assessment Theories and Methodologies

Chairs: Urbano, Diana

Room: 50 people, theater style, 3 people presidency table, video projector and computer, area mezzanine up of the conference center

Date and time: 2018-04-18 10:30

Effective computer-assisted assessment: challenges and solutions

Authors: Moscinska, Katarzyna; Rutkowski, Jerzy

Organisations: Silesian University of Technology, Poland

In the paper we describe revision of both resources and methodology of e-assessment, undertaken in the last few years. As students tend to ignore activities that do not directly contribute to grades, we proposed an intermediate method of assessment, named "formative towards summative" (FTS1, FTS2). Another reason for revision was introduction of "flipped classroom" in a leading engineering course and necessity of obtaining correlation between econtent and e-assessment. Application of Information Theory model confirmed the effectiveness of our approach

Structured Peer Review using a Custom Assessment Program for Electrical Engineering Students

Authors: Mirmotahari, Omid; Berg, Yngvar

Organisations: Universitetet i Oslo, Norway; University College of Southeast Norway

Peer review is an increasingly common method that can help improve learning outcomes. In this study, the students are peers/reviewers for their fellow students. This study was conducted using a trial exam as a starting point for a peer review process. A custom assessment computer program was designed for structured implementation of review. The study shows that students who participated in the peer review consistently received better results on the final exam. This suggests that structured peer review by students improves learning outcomes. This paper also demonstrates that the collected data can be useful to lecturers who want to improve their constructive alignment.

Regional Assessment Of General Education Quality In Tomsk Region

Authors: Mozgaleva, Polina; Zamyatina, Oxana; Cabral, Pedro; Mozgaleva, Alena

Organisations: Tomsk Polytechnic University, Russian Federation; Tomsk State University, Russian Federation; NOVA IMS - Universidade Nova de Lisboa, Lisbon, Portugal

From 1998 Tomsk region holds the regional monitoring research with the goal of receiving actual information on the condition and dynamics of the quality of education, and also the liquidation of lacks in the knowledge of school learners (hereinafter learners) of educational institutions of the system of general education in Tomsk region. The article provides information on the stages of organization and provision of the regional monitoring; the model of the analysis and interpretation of the received data is demonstrated for further application of the monitoring research results by educational organizations of Tomsk region.

Industry – academia cooperation for creative thinking skills strengthening of undergraduates' and master students in electrical engineering

Authors: Kunicina, Nadezhda; Zabasta, Anatolijs; Gaile-Sarkane, Elina; Zhiravecka, Anastsija; Ribickis, Leonids

Organisations: *Riga Technical University, Latvia*

Training a new generations of engineers, who will create new enterprises and new products for market in the field of electrical engineering is achieving through supporting of individuals creative thinking. In this work, introduction of innovation management course for undergraduate students of the Institute of Electrical Engineering and Electronics, the top down and bottom up approach related cooperation with industry is described. Teaching methods such as a project – based method, mentoring approach, double supervision of scientific research development, industrial internships and final prototyping are discussed. The case of visiting students training in a frame of ERAS-MUS+ projects, applied testing methodology and results analysis, is discussed in this work.

Evaluation of Grade Prediction using Model-Based Collaborative Filtering methods

Authors: Rechkoski, Ljupcho; Ajanovski, Vangel V.; Mihova, Marija

Organisations: Ss. Cyril and Methodius University in Skopje, Macedonia, Macedonia, Former Yugoslav Republic of

Estimating grades for courses that are yet to be enrolled by students can help them in making decisions towards timely graduation and achieving better overall results. This paper presents an evaluation of grade prediction for future courses using the model-based collaborative filtering methods: Probabilistic Matrix Factorization and Bayesian Probabilistic Matrix Factorization using Markov Chain Monte Carlo. The prediction model was evaluated in a simulated scenario of an enrollment cycle in a winter and summer semester, based on a real data-set of enrollments and grades over several years at the authors' institution. Several evaluation metrics were used in order to assess the accuracy of predictions and analyze the distribution of the prediction deviation across study programs and grades. Beside the standard approach in predicting the final grade that is to be achieved by a student in a future course, we have also devised a method to estimate if the student will fail the course, so that he will have to re-enroll it at least once. The results showed that the predicted grades were in the range ± 1 compared to the actual grades in more than 80% of the records.

Exploring students entrepreneurial mindset. Insights to foster entrepreneurship in engineering education

Authors: João, Isabel M.; Silva, João M.

Organisations: ISEL - Instituto Superior de Engenharia de Lisboa, Instituto Politécnico de Lisboa; CEG-IST, Instituto Superior Técnico, Universidade de Lisboa, Portugal; ISEL - Instituto Superior de Engenharia de Lisboa, Instituto Politécnico de Lisboa; CATHPRO/CQE, Instituto Superior Técnico, Universidade de Lisboa, Portugal

High school graduates have a huge potential for innovative processes and sustainable economic development. The higher education institutions must play an important role in engaging students for entrepreneurial careers, enhancing their skills to entrepreneurship activities. Students capable of identifying opportunities and turning ideas into business, and who have good communication and leadership skills as well as strong technical competences are likely to be highly valued in the marketplace. This paper presents a case study which the main objective is to investigate the main differences within and across students who are and are not participating in entrepreneurial courses. The main concern of the study is to understand if the students are or are not interested in entrepreneurship activities and what are the engineering student's perceptions of their entrepreneurship related abilities. The students were selected among two engineering master courses in a Portuguese Engineering School of a Polytechnic Institute. The curricular unit of entrepreneurship is part of the curriculum in one of the master courses while in the other course the students do not have such subject in their study program. The data was collected to investigate differences within and across engineering students who are and who are not participating in entrepreneurship courses as well as differences concerning some demographic characteristics.

(1E) Active learning and Active Methodologies

Chairs: Absi, Rafik

Room: 60 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-18 10:30

Training Undergraduate Engineering Students To Read Research Articles:A Qualitative Think-Aloud Study

Authors: Seiradakis, Emmanuela; Spantidakis, Ioannis

Organisations: University of Crete ; Technical University of Crete; University of Crete

Training Undergraduate Engineering Students To Read Research Articles: A Qualitative Think-Aloud Study

The ability to read research articles in English is considered an essential skill for university students. Lately, the instant online access to research articles has changed both the amount of articles and the age scientists start reading primary literature. In engineering education professors seem to believe that sensitizing undergraduates to the research article genre, could contribute in facilitating their disciplinary socialization and help them acquire fundamental engineering skills such as reading and writing reports and interpreting data. However, existing research on the use of research articles with engineering undergraduate students is scarce. In this paper, we report on the effects of a blended course that aimed to help ECE undergraduates to read research articles more effectively and quickly. The 15week experimental course was based on the theories of genre analysis, metacogniton and cognitive apprenticeship. The study adopted a pre and post-test design combined with concurrent think-aloud protocols. Four EFL Greek undergraduate ECE students at the Technical University of Crete were selected based on certain criteria that classified them as poor readers. The think-aloud sessions were recorded, transcribed and analyzed based on an open coding approach. The data indicated that prior to the course participants lacked a schema for the research article genre and thus their reading strategies were ineffective, whereas at the posttest participants made more use of strategies to plan, monitor, control and evaluate their comprehension.

Addressing Chemical Reaction Misconceptions Using Five Phase Needham Model

Authors: Surif, Johari; Tamilselvam, Shanthi; Ibrahim, Nor Hasniza; Abdullah, Abdul Halim; Ali, Marlina

Organisations: Universiti Teknologi Malaysia, Malaysia; SJK(T) Jalan Haji Manan, Kluang, Johor, Malaysia

This study aims to assess and address the misconceptions that exist in the chemical reactions topic among form five students. The study uses Five Phases Needham Model that apply in the multimedia software to overcome the misconceptions that exist in this area of chemical reaction in the classroom instruction. The study also used ADDIE Model (Analysis, Design, Development, Implementation and Evaluation) to develop a multimedia software. Thirty secondary school students and thirty secondary school teachers took part in this quantitative study which uses the experimental and survey methods. A pre-test and post-test were used to assess the effectiveness of the software in overcoming misconceptions developed by students in the area of chemical reactions. In addition, the study also collects data from teachers through a questionnaire to test the suitability of this software. Data of pre and post tests and questionnaires were analysed using descriptive statistic. The results showed that this multimedia software is very effective to be practiced

in schools among students. The survey also reveals that the software is suitable from various aspects such as understanding of learning content, navigation of software and increase of intrinsic motivation of students. Besides, this study also benefits from the perspective of providing information about the compatibility of multimedia software in Chemistry Education. In fact, secondary school teachers can use this study and the software as a reference or guide for deploying multimedia in teaching and learning.

Research Competence - Modification of a Questionnaire to Measure Research Competence at Universities of Applied Sciences

Authors: Hauser, Florian; Reuter, Rebecca; Mottok, Jürgen; Gruber, Hans

Organisations: OTH Regensburg, Germany; University of Regensburg, Germany; University of Turku, Finland

Connecting research and teaching is nowadays a very popular and common appearance in higher education. Research oriented teaching methods are getting more popular and important in the curricula. By using these methods, it is intended to enhance students abilities to do scientific work more independently. There is only a small number of tools, focused on the evaluation of these teaching methods outcomes.

This paper deals with the validation and modification of the German questionnaire "F-Komp". In its original version, it was intended to measure university students' research competences. In the beginning of this study, there were only a few tools available which were reliable. For the purposes of this study, they were not suitable. At the same time, there was no validated version of the F-Komp available, which made the whole validation process for further usage necessary. This questionnaire is based on a structure, which consist of different skills and knowledge and is focused on measuring research competence in general. The validation and modification of the F-Komp is therefore the aim of our contribution as well as a revised version of the questionnaire. We proceeded an explorative factor and a reliability analysis to do a general evaluation of the tool. Some modifications were done in the questionnaire to make it more suitable to the requirements of technical oriented universities of applied sciences. Our revised version is slightly longer and contains several items to gather data about the participants demographics. The modified questionnaire is based on a more appropriate factor structure. This structure is more practically oriented and pays attention to ethical issues. In future cases, this questionnaire will be used in research oriented courses to measure students' progress in acquiring the knowledge and methods which are necessary to perform as a scientist in different research areas.

Capstone Design: A Vehicle to Explore Landscapes of Practice in Engineering Education

Authors: Simpson, Zach; Janse van Rensburg, Nickey

Organisations: University of Johannesburg, South Africa

Engineering design capstone courses create an opportunity for students to demonstrate their familiarity with the particular landscape of practice of their chosen field. This research follows a team of seven final year Mechanical Engineering students as they complete a capstone design project to design and build an energy efficient vehicle to be entered into an international race. A qualitative, ethnographic study was conducted, collecting data through observation, reflection, and interviews with each of the student-participants and their academic supervisor. Landscapes of practice are defined through patterns of interaction within and between the various communities occupying the landscape. How we design the landscape of practice determines the opportunities we create for student development. The research demonstrates how the institutional and technological backdrop of capstone design introduces pressures that can both hinder student learning and create space and opportunity for deep learning to occur. It is concluded that the engineering curricula should include a series of design projects which allows for conceptualisation to operation of the final product, challenging students learning both with respect to technical and social skills.

Development of spatial awareness and operation skills in a remote robot laboratory

Authors: Verner, Igor; Gamer, Sergei; Polishuk, Alex

Organisations: Technion - Israel Institute of Technology, Israel

Our study investigates the development of spatial awareness (SpA) of first-year industrial engineering students through practice in programming and operating robot-manipulators. At the previous stage we found that practice in a virtual environment followed by direct "faceto-face" operation (FFO) of real robots can enhance students' SpA. At this stage we ask if FFO can be substituted by tele-operation in a remote environment without compromising the growth of SpA. What specific spatial challenges of robot tele-operation and what are students' perceptions of this practice? A robotics workshop was delivered as part of the Introduction to Industrial Engineering and Management course to two groups of students: one practiced FFO in the lab and the other remotely operated the robots from the computer class. Data were collected by two questionnaires. The first was administered after the workshop in both groups and asked to evaluate its learning contribution, including the gain in SpA. The second was conducted only in the experimental group and asked about

the spatial challenges faced in performing the tele-operated assignment. We triangulated results of the questionnaires by the analysis of students' laboratory reports and observations during the laboratory sessions. As fond, both groups positively evaluated the workshop's contribution, but evaluations of the tele-operation group were higher for the exposure to industrial robotics, interest to study robotics, and SpA. The students from the tele-operation group had specific challenges related to the limited viewshed and delayed visual feedback. Most students in both groups noted that the practice in the virtual environment was important to prepare for the practice with the real robots. Based on the results of our case study, we argue for further exploration of the proposed approach and call for using laboratory practice in remote robotic environments for training spatial skills that are highly demanded in engineering education and careers.

The Lecture Hall Laboratory - Design of a Field Experiment for Effectiveness Analysis

Authors: Nofen, Barbara; Temmen, Katrin

Organisations: University of Paderborn, Germany

The teaching and learning concept "Lecture Hall Laboratory" (LHL) is an ideal supplement to an engineering lecture with laboratory experiments, where students may individually perform their own experiments in small groups during the lecture. The integration of practical laboratory experiments into the lecture is based on the sandwich-principle. The key objectives are: promoting the learning process, deepening the subject issues and reducing difficulties of understanding.

The analysis design presented herein should allow now for the evaluation of the teaching and learning concept LHL with regard to learning success, motivation and its attractiveness. Besides the design of the field experiment, the operationalization difficulties, such as controlling confounding variables, will be discussed.

(1F) New Frameworks for Engineering Education

Chairs: Nedeljkovic, Milos (Srecko)

Room: 140 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-18 10:30

Work in Progress: Fostering synergy to create an innovation environment

Authors: Valadares, Eduardo de Campos

Organisations: UFMG, Brazil

This paper highlights major aspects of our endeavor to create a functional innovation environment at our university linking academia to the local innovation ecosystem.

Engineering 4.0 Education – A Proposal for a new Curricula

Authors: Ramirez-Mendoza, Ricardo A.; Iqbal, Hafiz; Parra-Saldivar, Roberto; Morales-Menendez, Ruben; Orta, Pedro

Organisations: Tecnológico de Monterrey, México; Massachusetts Institute of Technology, USA

Te paper describe a new curriculum for Engineering Education 4.0 based on the analysis of different references and essential relevant documents that explain the necessity to well-formed a new generation of professionals. Considering the technological change that world is going through, our current social environments and generational differences in a society focus on the extraneous and declares itself as the savior of the world. The university rises as a relevant and essential agent to ensure knowledge and development of competencies in this fourth industrial revolution, which has been called Industry 4.0 (I4.0). A series of digital technologies converge in applications transform the industrial processes so that they become more connected, reliable, predictable, resilient, and a high degree of certainty. All of this is due to the articulation of several capabilities of information technologies. Several efforts have been detonated in the world trying to better understand this evolution and in particular for Engineering Education towards the I4.0.

Towards a Disruptive Active Learning Engineering Education

Authors: Cruz-Matus, Lorena; Vasquez, Elisa; Rios, Horacio; Ramirez-Mendoza, Ricardo A.; Siller, Hector; Cabeza-Azpiazu, Luis; Hernandez-Luna, Alberto; Ahuett-Garza, Horacio

Organisations: Tecnologico de Monterrey México; University of North Texas USA

Challenge Based Learning has been proposed as a teaching-learning technique that helps students develop skills and competencies. A challenge exposes the students to the solution of problems under conditions far out of their comfort zone. A model for the deployment of this technique has been developed at Tecnologico de Monterrey. The model takes the student through a full semester project in an industrial environment. Specific course contents are taught in a modular way during the semester. The model has been labeled i Semester. This article describes some of the challenges of the implementation of the model.

Empathy and Virtual Agents for Learning Applications

Authors: Gil, Rosa Maria; Padilla, Natalia; Paderewski, Patricia; González, Carina **Organisations:** Universitat de LLeida, Spain; Universidad de La Rioja, Spain; Universidad de Granada, Spain; Universidad de la Laguna, Spain

Nowadays, feelings and emotions are included in applications design and evaluation in virtual learning applications. Communication quality is enhanced between the user and the application if emotions are included in the interaction process. Thus, in order to avoid negative emotions as boredom or frustration, we present empathy as another approach to maintain the engagement as contribution to cope the challenge of designing better quality virtual learning applications. Thus, we present a set of guidelines for the Empathic Virtual Agents (EVA) architectural design:

An EVA must have these characteristics to satisfy students needs:

• Communication: EVA must react immediately to emotional user behavior using biometrics

• EVA Architectural Design: A behavioral ontology is necessary to develop an accurate agent behavior integrated in an emotional database and a reason inference.

• Context configuration: EVA must know the context where the communication is taking place.

• Ethics policy: students have the right to know the laws behind data storage. However, here it is necessary to go beyond that. Confidential information about students as traits of personality, diseases, incapacities or behavioral disorders among others have to be regulated in order to preserve ethics. There is a danger in how an EVA can use this information in the inference process to influence in the student behavior.

Irony/tone discrimination: A sentence can change its meaning depending of tone. Sense of humor can be a powerful tool if it is used precisely

Understanding Engineering Education Change with the Introduction of Challenge Driven Education in Tanzania

Authors: Högfeldt, Anna-Karin; Lantz, Ann; Gumaelius, Lena; Lujara, Suzan

Organisations: *KTH Royal Institute of Technology, Sweden; DIT, Dar Es Salam Institute of Technology, Tanzania*

This paper presents findings from an ongoing engineering education development project, where one university in Tanzania and one in Sweden and Tanzania have collaborated since 1976 in research projects. A PhD sandwich program was established in the 90's in the field of electrical engineering between UDSM (University of Dar es Salam), Tanzania and KTH (Royal Institute of Technology), Sweden. This collaboration has opened up for shared trust, idea exchange and the emergence of the challenge driven education approach. Challenge driven education brings in socio-technical challenges to engineering education, or rather, brings out students and academic faculty, to real life challenges outside academy. The research of the first years' experience reveals high motivation among students, faculty and stakeholders in society. New ways of teaching and learning have evolved, and clear contrasts with traditional education have been found.

An Online DC-Motor Test Bench for Engineering Education

Authors: Baltanyan, Sarko; Kreiter, Christian; Pester, Andreas

Organisations: Carinthia University of Applied Sciences, Austria

The integration of practical lab sessions in engineering education plays a significant role for students in understanding fundamental physical principles and engineering concepts. Online laboratories aim to provide practical experiences without geographical or time constraints, and therefore provide more flexibility in education. The online lab presented in this paper is a DC-motor test bench and primary targeted at students of electrical engineering. The paper discusses the implementation of the lab in terms of hardware, used software frameworks and user interface, as well as possible applications in education together with five exercises.

(1G) Knowledge and Competencies in Engineering Education

Chairs: Sánchez de la Rosa, José Luis

Room: 340 people plenary room with speaker and presidency table located in the basement at the right of the reception

Date and time: 2018-04-18 10:30

Motivation and Attitude of Computer Engineering Students toward Soft Skills

Authors: Schipper, Mariecke; van der Stappen, Esther

Organisations: *HU University of Applied Sciences Utrecht, Netherlands, The*

To find, design and create solutions to global challenges, 21st century engineering professionals work in multi-disciplinary and international teams that are expected to work effectively and efficiently. Universities are following this trend, as they acknowledge the importance of soft skills for employability. The integration of soft skills in higher education curricula is not straightforward, especially in engineering education. At our university, soft skills courses score low in student satisfaction surveys. This motivational problem seems to be widely recognised. Therefore, in this paper, we study the motivation, attitude and anxiety of computer engineering students toward learning soft skills. To do so, we performed a quantitative study using an online survey based on the mini-AMBT. We sent the survey to all students of a computer engineering Bachelor program. We received 235 valid responses out of 1169 sent surveys, which corresponds to a response rate of 20.1%. We performed T-Tests for the five categories from the mini-AMTB survey instrument for the sample. Overall, our data indicate that computer engineering students acknowledge the importance of soft skills and have a positive motivation and attitude toward learning soft skills from both an integrative and an instrumental perspective. We also performed an ANOVA, from which we can conclude the soft skill anxiety increases significantly in our sample from the first to the third year, which is unexpected. The attitude toward the learning situation also decreases a bit during the studies. Also, the obtained results do not give clear insights as to what causes the motivational problems and low satisfaction scores for soft skill courses. All the above calls for further, qualitative research. We only studied the motivation and attitude of computer engineering students in a Dutch university of applied sciences; the motivation and attitude of students in other disciplines and countries of course may differ and should be studied separately.

Application of Systems Engineering Approach in Senior Design Projects

Authors: Alblawi, Adel; Nawab, Mohammad Sadique; Alsayyari, Abdulaziz

Organisations: Shaqra University, Saudi Arabia

This paper presents a novel approach to maximize the success of the Senior Design Project (SDP) in engineering program and to implement a systematic assessment approach to evaluate the student's performance during such project. SDP shares many characteristics that can be formulated as a complex design problem. Designing and delivering the SDP is achieved by applying a System Engineering and utilizing the systems engineering process in the development and production of the SDP of engineering students. The effectiveness of the approach is demonstrated through a case study of civil engineering project at the college of engineering, Shaqra university and the results of a survey that was conducted by the end of the course. The objective of this paper is to show how the systems engineering approach can be beneficial in delivering the final product/system of SDP.

Closing the loop in engineering educator development: Using theoretical and empirical research to inform curriculum and teaching

Authors: Wolff, Karin Elizabeth

Organisations: Cape Peninsula University of Technology, South Africa

An emerging challenge in engineering education is the rapid proliferation of increasingly complex technologies and contexts of sociotechnical application. This challenge sees lecturers grappling with what to include in the curriculum and how to best harness technologies to enable both students' conceptual understanding as well as the eventual ability to engage with engineering technologies in the work place. In order to enhance engineering educator capacity, a number of professional development initiatives are underway in South Africa. Drawing on two different case study sites, this paper presents an argument for exposing lecturers to the results of theoretically-informed empirical research on engineering problem solving in industrial sites. Using the problem-solving maps generated across 40 industrial case studies and the underpinning analytical tool from Legitimation Code Theory, industrial and process engineering academics were afforded the opportunity to apply the tool to their analyses of curriculum and software-based subject teaching approaches. Results of the staff development initiative indicate that closing the loop between an understanding of the incoming student base and actual curriculum/teaching practices by including real world industrial problem-solving research enables the holistic adoption of iterative feedback and feed forward pedagogic strategies.

Mathematical vs. engineering understanding: engineering educators' perspective

Authors: Trotskovsky, Elena; Sabag, Nissim; Raveh, Ira

Organisations: ORT Braude College, Israel

I. INTRODUCTION

Our world is characterized by an accelerated creation of new knowledge that spreads rapidly and is available online. Thus, teaching for dealing with knowledge, and particularly, teaching for understanding has become the trend, rather than the traditional teaching of knowledge.

What is understanding? How engineering educators perceive this concept? Is there a difference between understanding in mathematics and in engineering? How engineering educators teach for understanding? These questions were posed into the current research.

II. THE RESEARCH SETTINGS

A. Method

The research was carried out in April - August 2017. A qualitative method - a comparative analysis - was chosen for the study. The main research tool was a about understanding and the methods of teaching for understanding. Seven lecturers of mathematics and different engineering disciplines from an academic college of engineering were interviewed, and their answers were analyzed.

B. Participants

Two mathematicians and five engineers participated in the study. One of them is an electronics engineer and the four others are mechanical engineers. All the participants hold a PhD degree, and two of them, lecturers of mathematics and mechanics engineering, hold a professor title. Most of the lecturers have significant experience in research, engineering practice and education. Four interviewees have more than 25 years' experience in industry or academia, three lecturers have been working for more than 10 years, and one engineer has eight years' experience in research and education.

IV. CONCLUSION

Most of the lecturers perceive understanding as creation of a knowledge system with internal and external connections. The lecturers of engineering disciplines emphasize the applicative trait of understanding, namely, the ability to use these parts. The difference between the aims — knowledge broadening in mathematics versus knowledge application in engineering seems to be the reason for the varied perceptions on understanding among the mathematicians and engineers.

Defining Competence-Oriented Learning Objectives and Evaluating Respective Learning Outcomes for Theses Statements

Authors: Böttcher, Axel C.H.; Hammer, Sabine; Thurner, Veronika

Organisations: niversity of Applied Sciences Munich, Germany

Every student has to write a thesis statement at the end of their study programme. However, despite of this universality, both the process of supervision and the criteria used in the process of grading theses statements vary widely.

In literature, there is a gap regarding the definition of demands and expectations on theses statements from a competence-oriented point of view. A thorough investigation of cognitive, non-technical competences that are required to successfully accomplish a thesis project and write the thesis itself has not yet been performed.

In this paper, we propose a set of competences that are required to perform a thesis project and to create a thesis statement. Our goal is to apply the principles of constructive alignment to the supervision of thesis statements, as it is commonly done for lecture-based or lab-based teaching.

Based on a review of literature and module specifications, we specify requirements for thesis statements and use them as a basis for deriving appropriate learning objectives for thesis projects. Then, we identify cognitive competences that are required to fulfill these learning objectives. On this basis, recommendations are developed for teaching practices in the process of supervision, as well as for grading of thesis statements.

Using Grounded Theory Methodology to Discover Undergraduates' Preconceptions of Software Engineering

Authors: Gold-Veerkamp, Carolin

Organisations: University of Applied Sciences Aschaffenburg, Germany

As software becomes more and more important in our everyday life, young people have to get the right qualifications for jobs such as programmers, software architects, and software engineers. Since Software Engineering is a relatively new discipline, its didactical foundation is still in its infancy, which contrasts the growing importance and our rising dependence on technology. As a consequence, the goal is to improve learning by using "positive" conceptions of students as "points of departure" and reduce learning obstacles by facing isconceptions. As a first step in this process, (pre-)conceptions have to be identified. Therefore, the paper covers a specification of Grounded Theory, the way it was created and developed further, a presentation of three variants and relevant points of similarity and difference. Furthermore, the research topic of the upcoming study and reasons why GT seems to be a promising research approach regarding the research goal as well as its operationalisation according to this research topic will be displayed.

(2A) Collaborative work and Technologies for Engineering Education

Chairs: Christou, Charalambos Stephanou

Room: 50 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-18 15:00

Containerized Education by the Up2U Consortium

Authors: Szegedi, Peter

Organisations: GEANT, Netherlands, The

Building container schools is not only the peculiarity of the developing world regions these days. With the ever growing demand for quality education, the physical space for student classrooms in many European cities is getting to be scarce. As new residential areas are growing up quickly, the easiest and cheapest way is to put some containers together in a suitable setup and students can immediately start learning.

This concept motivated the Up to University (Up2U) project consortium in developing its architectural vision, heavily relaying on modularity. We believe, if we created the right conditions students will learn naturally. The original LEGO approach of the Next Generation Digital Learning Environments (NGDLEs) published in 2015 is often challenged by the personalized learning needs. Standard shipping containers may fit very well on top of one another but they have to be made suitable (equipped with furniture) as well as loveable (painted in colors) for children to use them as their schools. This is true for the digital learning environments too. There are so many moving elements that need to be tuned in order to provide the best teaching and learning experience.

Up2U is designing, developing and deploying a NGDLE with existing components, where pos-

sible using open source software, that are glued together in a specific way. In contrast with the market leaders who obviously put their particular products in the center of their universe, Up2U is putting the emphasis on interoperability, modularity and portability. Just like container schools, the containerized education platform provided by Up2U creates the right conditions for students to learn in the digital space.

Fostering Social Construction of Knowledge in Hybrid Teams by Augmented Reality

Authors: Schiffeler, Nina; Stehling, Valerie; Haberstroh, Max; Isenhardt, Ingrid

Organisations: *IMA/ZLW - RWTH Aachen University, Germany*

Social construction of knowledge is characterised by a collaborative team setting in learning processes. New instructional and collaborative technologies e.g. smartphones, Augmented Reality (AR) technologies and robots are prototypically used in such educational contexts and foster collaboration due to their interactive nature [1]. Particularly in vocational training, learners profit from the use of collaborative hardware since these technologies continuously find their way into working environments. Robots, for example, are almost omnipresent in industry and production, forming (hybrid) teams with human workers. Future professionals, thus, do not only need to develop technical knowledge but also media competences in terms of the effective use of (new) technologies in both learning and working contexts. The design of human-robot interaction (HRI) based on human-centred factors in the interaction and collaboration with robots in both learning and working contexts is still a field hardly researched on [1, 2, 3].

By such modern and practice-oriented education using technologies like AR, learners actively prepare for an employment market characterised by a comprehensive digitalisation and interconnection (industry 4.0). Moreover, social construction of knowledge is assumed to be a new challenge in terms of the emergence of industry and knowledge societies. It is, thus, essential to (further) develop respective media literacy skills in order to meet the challenge. The human perspective on the effectiveness of such technologies, however, has rarely been investigated so far. As a consequence, this concept paper describes a SWOT analysis on the use of digital instructions on HRI social knowledge construction. It also provides an evaluation scheme for investigating the effect of digital instructions in HRI learning contexts.

Including Part-Whole-Thinking in a Girls' Engineering Course through the Use of littleBits

Authors: Pancratz, Nils; Diethelm, Ira

Organisations: University of Oldenburg, Germany

A basic principle of Computer Science is to break problems down into parts. Object Orientation, the paradigm Divide and Conquer, and Modularity are only three examples that make use of Part-Whole-Thinking, which is a fundamental skill enabling Life Long It includes the ability to cogni-Learning. tively (and often subconsciously) identify Part-Whole-Relationships, which help us to understand objects, systems, processes, definitions, and concepts. As part of a two-year Girls' Engineering course held at a Northern-German secondary school it was tried to improve students' overall understanding of Information Technology by including Part-Whole-Thinking into its course content. The way this was done was through the use of littleBits for rapid prototyping of various Internet-of-Things devices. In this short paper, this practical approach is presented and the advantages in explicitly making Part-Whole-Thinking a central topic in class are discussed.

Implementation of Online Problem-Based Learning for Mechanical Engineering Students

Authors: Andersson, Christina; Logofatu, Doina

Organisations: Frankfurt University of Applied Sciences, Germany

An online B.Sc. program in mechanical engineering offers the students a flexible way to obtain a university degree in engineering, parallel to work and family life. However, the lecturers of the online program face the challenge to keep the students in the courses. The rate of dropouts can be reduced if the students participate actively in the course and feel responsibility and community with other students. These factors can be promoted by cooperative learning techniques, e.g. problem-based learning. This paper presents how problem-based learning was applied to an introductory laboratory class, taught completely online, for mechanical engineering students. We discuss the teaching framework of the laboratory class, as well as the results from the first in-class usage of the approach. Furthermore, a comparison with a previously used technique is given.

Using Cultural Heterogeneity to Improve Soft Skills in Engineering and Computer Science Education

Authors: Andersson, Christina; Logofatu, Doina

Organisations: Frankfurt University of Applied Sciences, Germany

If an engineer obtains correct conclusions, but cannot communicate these results in a proper way, then the value of the achievements could be diminishing dramatically. Awareness about the importance of acquiring soft skills in addition to technical knowledge is often present in engineering education, but the issue is still how the improvement of these key competencies should be addressed. Often our engineering classes are heterogeneous, both with respect to pre-knowledge of the mathematical and technical skills, but also concerning the cultural background of the students. This can be an additional challenge for the teaching situation. Instead of considering the cultural heterogeneity as an obstacle, we decided to use it as an advantage for enhancing soft skills in a mathematics course. In this paper, we describe a multicultural-based teaching approach for improving soft skills in engineering and computer science education.

A Remote Mode High Quality International Master Degree Program in Environomical Pathways for Sustainable Energy Systems (SELECT) –Pilot Program Experiences During First Year of Studies

Authors: Abeyweera, Ruchira Rohanajith; Senanayake, Nihal S.; Jayasuriya, Jeevan Perera Weeraratne; Fransson, Torsten Henry

Organisations: The Open University of Sri Lanka (OUSL), Sri Lanka; Royal Institute of Technology (KTH), Stockholm, Sweden; EIT InnoEnergy, Stockholm, Sweden; EIT InnoEnergy, Netherlands

Remote mode study programs at master degree level are becoming more popular than undergraduate level programs. Students after graduation with Bachelors degree very often are employed and the most appropriate mode for them to pursue higher studies is the remote mode. Postgraduate programs with one or two year duration mostly focus on specific areas of research based industrial application. Traditional remote education is thought to be more centered on web based on-line programs with a little opportunity for teacher student interaction and interaction with peers. In such programs motivation for studies has been a problem and as a result many students drop off and also those remain in the program for prolonged periods do not show good performance. One of the reasons for failures of students in remote

studies is the isolation leading to discouragement for the completion studies.

A remote mode Master Degree Program in Environomical Pathways for Sustainable Energy Systems (MSc-SELECT), consisting of a number of innovative features aimed at improved student engagement, motivation, exposure to experiences in multi-national setting and team work, was developed and implemented by the Master School of the EIT-InnoEnergy, as a pilot project. The program was offered, collaboratively and simultaneously to students in three locations, Royal Institute of Technology in Sweden, Universitat Politecnica de Catalunya in Spain and the Open University of Sri Lanka. The students in Sweden and Spain each followed 50% of the courses on-campus and 50% in remote mode depending upon the university they registered with. The students in Sri Lanka followed the entire 1st year fully remotely. All the students (from KTH, OUSL and UPC) will spend the 2nd year on-campus at another university in the consortium. This paper discusses, from the perspective of the fully remote site, the remote program with its innovative aspects, student performance and experience together with future tasks for making the program viable and beneficial to all partner countries.

(2B) Systems and Technologies for Learning

Chairs: Blázquez-Merino, Manuel P.

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-18 15:00

Work in Progress: Computing Cluster using IoT Technologies

Authors: Madritsch, Christian; Klinger, Thomas **Organisations:** Carinthia University of Applied Sciences, Austria

This paper describes the design, implementation, and practical use in Engineering Education of a Computing Cluster using IoT technologies. First, the development goal and its expected application is explained. Current lectures in Computer Science, Computer Engineering and Image Processing will benefit of the massive parallel computing cluster. Next, the design and implementation - carried out by a group of students - are described in detail. Finally, the practical use of the cluster including a test application is shown. Here, current super-computing methods like Message Passing Interface (MPI) and Open Multi Processing (OpenMP) are used to show the ability and functionality go the cluster.

Design Concept and Prototype for an Augmented Reality based virtual preparation laboratory training in Electrical Engineering

Authors: Alptekin, Mesut; Temmen, Katrin

Organisations: University of Paderborn, Germany

There are numerous studies so far highlighting the potential of Augmented Reality (AR) in different educational domains and its impact on learners regarding their increased motivation, improved learning, concentration on the topic etc. Ever since high-end AR applications could be used on smartphones, this technology has become suitable to be used in many formal and informal learning environments and educational institutions, beginning with Arts courses in preschool over Biology, History, Chemistry, Physics etc. in K-12 and universities as well as in vocational training schools, e.g. for assembly trainings.

A major problem at the University of Paderborn during the compulsory laboratory practices is the lack of students' operation skills to operate the electro-technical laboratory equipment.

Hence, this paper investigates and focuses at a design concept for a mobile device based AR application (App) to acquire and deepen practical skills in dealing with electro-technical laboratory equipment.

Augmenting educational videos with interactive exercises and knowledge testing games.

Authors: *Kleftodimos, Alexandros; Evangelidis, Georgios*

Organisations: Western Macedonia University of Applied Sciences, Greece; University of Macedonia, Greece

The use of online videos is a common practice today in education and this is evident from the abundance of free online courses that are delivered by universities, educational organizations as well as individual professionals. In most cases, the videos that exist in educational platforms are linear without any scope for interactivity and in cases where there is interactivity this is mainly restricted to in-video quizzes. The aim of this paper is to present ways for going beyond the standard in-video quizzes by augmenting videos with various interactive exercises and games that test learners' knowledge. Furthermore, the paper presents a learning environment built using the concepts explained as well as how this environment was used and evaluated in educational settings. The outcome of the evaluation showed that learners attained positive opinions regarding the interactive environment features and its effectiveness in learning.

Development of a Signal Generator for Study Programs Dedicated to Electronic Engineering

Authors: Beneder, Roman; Schmitt, Patrick; Lechner, Markus

Organisations: UAS Technikum Wien, Austria

In courses dedicated to electronic engineering, theoretical knowledge and hands-on exercises are mandatory. The University of Applied Sciences (UAS) Technikum Wien offers various bachelor degree programs focused on electronic engineering. These degree programs are available in the form of full-time and distance learning. Moreover, the university promotes these degree programs to be adaptable for handicapped students as well.

Due to the fact, that distance-learning and handicapped students do not attend the university on a regular basis, it is necessary that they have the opportunity to complete their handson exercises and assignments at home. These tasks often require the measurement and analysis of analog- and digital circuits. In fact for this kind of tasks, it is necessary to have access to a signal generator. To be able to equip every student with this device, it is necessary to be affordable for the university. Another important aspect is that the application of the signal generator is operating-system independent and available to the open-source community to enable further development.

This paper introduces the development of a lowcost, opensource soundcard based signal generator and its usage within courses. Furthermore, this paper will give an overview about the developed hardware component, the required software architecture and the arbitrary waveform generation.

Adaptive technology to support talented secondary school students with the educational IT infrastructure

Authors: Shukhman, Alexander; Bolodurina, Irina; Polezhaev, Petr; Ushakov, Yury; Legashev, Leonid

Organisations: Orenburg State University, Russian Federation This paper describes the project of an automated adaptive system for individual support of talented students with the educational IT infrastructure. A model of the process of selflearning and self-development of talented students in the educational IT infrastructure is developed on the basis of a multilevel competence system using Petri nets. To design optimal student's individual learning paths algorithms of the ant colony have been used. Methods for calculating the relative values of the student's rating are proposed based on accounting their academic achievements in a specific subject area. A preliminary version of the Web portal has been developed to provide the storage of talented student's profiles with their achievements and ratings, information on courses and training competitions, ILP planning, user interaction, integration with external educational resources.

Exploring the Value of Zimbardo Time Perspective Inventory as Predictor of Academic Outcomes

Authors: Susnea, Ioan; Pecheanu, Emilia; Cocu, Adina; Dumitriu, Luminita

Organisations: University "Dunarea de Jos" of Galati, Romania, Romania

This paper is a brief presentation of a pilot study aimed to identify a set of (preferably ICT supported) instruments that can be used as predictors of the educational outcomes, with a special focus on the early warnings for dropout

In this context, the Zimbardo Time Perspective Inventory (ZTPI) appeared to be a reliable candidate, given the wide international validation and acceptance, and its previous successful application in predicting substance abuse risky driving health related habits, etc.

Starting from the existing literature on this topic, we expected to find some significant correlations between future oriented time perspective and better academic achievements, and higher levels of anxiety about the professional future.

We also expected to find a link between the present hedonistic perspective and higher individual creativity quotients.

Our sample consisted in N=56 Romanian students (13 females, and 43 males, aged between 21 and 24 years), at the Department of Computer and Information Technology of the University "Dunarea de Jos" of Galati, Romania. The students were instructed to use the original English version of the ZTPI available online (http://www.thetimeparadox.com/zimbardotime-perspective-inventory/) and to send us the results by email. Previously, they filled

a slightly modified version of the Bolanowski anxiety about the future (AAF) questionnaire, and passed a creativity test using the online assessment tool we developed in a previous project (http://dev.ugal.ro/creativity).

We also had access to information regarding their grade points (GP) recorded for six semesters.

Contrary to our expectations, the correlations the ZTPI F scores, grade points (GP) and Bolanowski AAF scores were not statistically significant.

Though our experiment is far from ideal, it appears that the value of the ZTPI instrument as predictor of academic outcomes is very limited.

(2C) Data and Learning in Engineering Education

Chairs: Stylianou, Vasso

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-18 15:00

Mining LMS students' data on online task-based master degree studies

Authors: Menacho, Antonio; Castro, Manuel; Perez-Molina, Clara Maria

Organisations: UNED, Spain

The use of information and communication technologies (ICT) in the educational processes has brought about a series of changes in students' behaviour while raising new challenges for teaching. The analysis of the data provided by the learning management systems (LMS) is essential to know the behaviour of students and improve educational techniques.

This behaviour may vary depending on the level of studies and the educational methodology used, and their knowledge allows determining various parameters to guide or implement improvements in the learning process.

The purpose of this study is to know the behaviour of students when connecting to the LMS in online studies that follow the taskbased methodology at the master level.

Analyzing the Needs of the Offshore Sector in Morocco

Authors: Khaouja, Imane; Rahhal, Ibrahim; El ouali, Mehdi; Mezzour, Ghita; M. Carley, Kathleen; Kassou, Ismail

Organisations: International University of Rabat, Morocco; Mohammed V University, Rabat, Morocco; International University of Rabat, Morocco; Carnegie Mellon University; Mohammed V University, Rabat, Morocco

The offshore sector creates a large number of job opportunities in Morocco. Analyzing job ads related to that sector can help universities adapt their curricula in order to produce more employable graduates. Unfortunately, analyzing these ads is challenging because they are mostly non-structured. Most prior work, however, focuses on analyzing structured and semistructured job ads through keyword search and regular expressions.

In this work, we collect and analyze job ads related to the offshore sector in Morocco over the period February-August 2017. We use a variety of machine learning and text mining techniques to process these ads. We examine the natural languages, programming languages, education level, and years of experience needed. We also examine contract type and salary when available. Our results reveal that French is the most needed language in offshore jobs, but that other foreign languages (English and Spanish) are also needed. We also find that the most needed offshore IT jobs are development and web design jobs. The most needed programming languages for these jobs are Java, SQL, JavaScript and PHP.

Designing IoT applications in lower secondary schools

Authors: Mavroudi, Anna; Divitini, Monica; Gianni, Francesco; Mora, Simone; Kvittem, Dag R.

Organisations: Norwegian University of Science and Technology, Norway; Markaplassen Ungdomsskole, Norway

The paper reports on a case study where four groups of lower secondary school students participated in a workshop and undertook the demanding role of designers of Internet of Things applications. In doing that, they made use of a dedicated inventor toolkit, which facilitated students' creative solutions to problems that can appear in the context of a smart city. From a pedagogical point of view, the workshop format is in line with the experiential learning approach. The paper presents a holistic student assessment methodology for this nice domain. In particular, to analyse the impact of the workshop for the students we used four different approaches: artefacts analysis of students' design solutions, classroom observations, a post-test and a survey. The results indicate that the intervention has promoted an effective

teaching methodology for the basic conceptual and design aspects of the IoT for these lower secondary school students, but it hasn't addressed equally effectively the attitude-related aspects. Nonetheless, the participant students perceived the intervention as very satisfactory in terms of the IoT concept knowledge, smart cities learning, and problem-solving skills acquired, as well as in terms of enjoyment. The paper concludes on the learning gains of the intervention, and discusses the motivation aspect for the teacher as well as for the students in this highly innovative learning experience.

GNU Radio as a tool for Significant-Learning in Digital Signal Processing: Implementing Digital FM Receiver Architectures

Authors: Ramírez, Germán Augusto; Saavedra, Miquel Angel; Caviativa, Yaneth Patricia

Organisations: Universidad Manuela Beltrán, Colombia; Universidad Nacional de Colombia; Universidad Nacional de Colombia; Universidad Manuela Beltrán, Colombia

This contribution presents an approach to strengthen the internalization of theoretical concepts related to digital signal processing -DSP and communications systems by means of active learning using the GNUradio framework, highlighting the experimental work in the strengthening of learning, resulting in a significant and autonomous learning for the engineering students that use the tool.

The case study is based on the implementation and comparison of a variety of digital detectors for angular modulated signals using GNUradio software and USRP N210 SDR transceivers. It shows an straightforward and flexible way to build and test digital receiver architectures avoiding the costs of licensed software, the obsolescence of specific mission educational equipment, and the complexities of custom hardware based realizations. Results show that user implemented blocks have capabilities comparable to the ones included in GNU radio library.

Embedded Smart Home – Remote Lab MOOC with Optional Real Hardware Experience for over 4000 students

Authors: Malchow, Martin; Bauer, Matthias; Meinel, Christoph

Organisations: Hasso Plattner Institute, Germany

MOOCs (Massive Open Online Courses) become more and more popular for learners of all ages to study further or to learn new subjects of interest. The purpose of this paper is to introduce a different MOOC course style. Typically, video content is shown teaching the student new information. After watching a video, self-test questions can be answered. Finally, the student answers weekly exams and final exams like the self-test questions. Out of the points that have been scored for weekly and final exams a certificate can be issued. Our approach extends the possibility to receive points for the final score with practical programming exercises on real hardware. It allows the student to do embedded programming by communicating over GPIO pins to control LEDs and measure sensor values. Additionally, they can visualize values on an embedded display using web technologies, which are an essential part of embedded and smart home devices to communicate with common APIs. Students have the opportunity to solve all tasks within the online remote lab and at home on the same kind of hardware. The evaluation of this MOOCs indicates the interesting design for students to learn an engineering technique with new technology approaches in an appropriate, modern, supporting and motivating way of teaching.

The influence of classroom attendance on the throughput rates of students at a FET college in South Africa

Authors: Swart, Arthur James

Organisations: Central University of Technology, South Africa

Student engagement with academics in a classroom environment is one of the oldest and well-known pedagogical strategies while having quality teachers in the classroom is but one indicator of possible student success. In Further Education and Training colleges in South Africa, an 80% classroom attendance is usually required for students to qualify to write their final national examination at the end of the term. The main purpose of this paper is to assess the influence of classroom attendance on the throughput rates of students in a National Certificate offered at a Further Education and Training college in South Africa. The research, on which this study is based, incorporates an ex-post facto study involving a nonexperimental correlation design using quantitative data. Results indicate a significant attrition rate of 72%. Senior students in Level 4 seemed to attend more class (average attendance is 55% with 63% passing) as compared to freshmen students in Level 2 (average attendance is 48% with 44% passing). Results further show that the throughput rates for Mathematics never exceeded 11%, while students performed very well in Workshop Practice and Electrical Workmanship (peak throughput rate of 100% for Level 3). A key recommendation is to alert management of the non-compliance with the 80% classroom attendance policy, which needs to be revised or re-enforced, so that awareness, transparency and accountability may be promoted.

(2D) $\mathbf{E} \cdot \mathbf{Assessment}$ and new Assessment Theories and Methodologies

Chairs: El-Abd, Mohammed

Room: 50 people, theater style, 3 people presidency table, video projector and computer, area mezzanine up of the conference center

Date and time: 2018-04-18 15:00

Development of Checklist for Systematic Research Communication in Multidisciplinary Fields

Authors: Nishiyama, Kiyohisa; Leleito, Emanuel

Organisations: Nagoya University, Japan

This paper proposes a systematic strategy for multidisciplinary research communication in engineering fields. Research problems in modern society are complicated and are difficult to solve with expert knowledge in a single field. In higher education and research, emphasis is being placed on multidisciplinary research with collaboration and communication across disciplinary boundaries. Solving such complicated problems through multidisciplinary collaboration is still difficult. This research categorizes research abstracts collected from researchers in various engineering fields into five research patterns based on the functional analysis approach. They are analyzed to examine the problems in multidisciplinary research communication. Finally, a research communication check sheet is proposed as a solution for the issues that were discovered through the analysis. The authors expect the check sheet will be useful as a systematic tool to aid multidisciplinary research communication and could be utilized in academic writing and presentations.

Self-assessment in PBL: a tool to develop self-confidence and autonomy of students

Authors: Lanthony, Antoine; Francois, Alexis; Azzouzi, ElMehdi; Peyret, Nicolas

Organisations: ISMEP-Supmeca, France; University of Cergy-Pontoise, France; ISMEP-Supmeca, France; QUARTZ laboratory – EA 7393, France

Problem- and project-based learning approaches place the students at the center of the learning processes and give the opportunity to make the students active and involved. It also prepares the students for their future

professional life by placing them in real situations with different stakeholders. The assessments implemented during problem and project phases allow to evaluate the acquisition of disciplinary skills and competences. This kind of teaching and learning also provides the opportunity to develop specific project skills giving more autonomy and agility to the students in complex problem solving. Knowing their level of acquisition of these skills is a key point for the students, making them more confident in face of the problems they have to solve. All these aspects have been widely experienced and are well documented. ISMEP-Supmeca, a French public engineering school, has chosen since decades to engage in problem- and project-based learning. Progressively, this approach developed through various axis, including educational research projects (IDEFI PLACIS, Erasmus+ strategic partnerships EPICES and EBCC). There are now three offers of this kind at ISMEP-Supmeca: one problem-based learning module for first year students, and two project-based learning modules for second and last year students. Moreover, a self-assessment process has been implemented in order to enable the students to self-assess their project mode skills. Students realize one self-assessment at the beginning of the module and one at the end. In the first one, they evaluate their skills before working with others and receiving feedback, whereas in the second one, their assessment results from the experience gained during the module. This paper presents the first results and the perspectives of this self-assessment experiment, which will continue to be developed.

Fair Exams in Split Groups (Implementation of Equitable Computer Based Exams for Large Groups in Small Test Centres)

Authors: Grotz, Norbert

Organisations: Kempten University, Germany How to provide a fair computer based exam for a large group, if only a small number of computers are available?

Just sequencing sub groups in exam time slots does eliminate the option to use the exact same test for all groups. Using different tasks for all groups may result in different difficulty levels for the consecutive groups.

This paper describes the principle of a rating system as part of a web based exercising platform, in which the rating outcomes can be used to provide different, but equally difficult tasks for sequenced exams groups. An important factor in this is the combination of subjective, personal feedback and clinical, algorithm based data in the rating system.

A Maximum Mutuality Model for Continuous Improvement in Engineering Departments

Authors: Damaj, Issam; Yousafzai, Jibran

Organisations: American University of Kuwait, Kuwait

In higher education, academic departments are always challenged by the need to succeed in operation while maintaining quality practices and outputs. It is common that departments need to adhere to multiple accreditation initiatives and standards at both the institutional and programmatic levels. In this paper, we benefit from the intersection between the improvement cycles of institutional and programmatic accreditations to propose a maximum mutuality model. The suggested model embeds program reviews, as required by ABET accreditation, within a departmental improvement loop. The model aims at being effective, productive, and easy-to-deploy; while responding to the needs for improvement at various levels. The application of the model is shown to be successful in assuring quality and leading to different accreditations. The paper includes thorough analysis, evaluation, and deployment results over six academic years.

A Didactical Concept for Supporting Reflection in Software Engineering Education

Authors: Engelbrecht, Lisa; Landes, Dieter; Sedelmaier, Yvonne

Organisations: University of Applied Sciences and Arts Coburg, Germany

Software engineering is concerned with the development of complex software systems and requires a high degree of interdisciplinarity. This presents great challenges for the learning of software engineering, since this complexity requires a comprehensive development of competences and in addition to the training of professional knowledge, the genesis of generic competences. The reflection process plays an important role in the educational debates in order to deliberately apply what has been learned and to facilitate the integration of theoretical contents of the study into practice.

A systematic investigation of the importance of reflection for the learning process of students in software engineering is, however, so far missing.

The paper outlines a qualitative research design that systematically researches the reflection process of the software engineering education. The focus is on the question of how to encourage student reflection in software engineering and to support it by the use of a learningoriented competence assessment system.

Motivation for students in Computer Science and Design

Authors: González, Carina; Sánchez de la Rosa, José Luis; Muñoz Cruz, Vanesa; Toledo Delgado, Pedro

Organisations: Universidad de La Laguna, Spain

A common problem is how to motivate students to learn. Most of the studies concern only one topic. That is, Engineering studies, for example. In the present paper we deal with the problem of motivating students from different degrees using different teaching strategies.

(2E) Active learning and Active Methodologies

Chairs: Strachan, Rebecca

Room: 60 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-18 15:00

Active Learning of Software Project and Quality Management

Authors: Sedelmaier, Yvonne; Landes, Dieter

Organisations: Coburg University of Applied Sciences and Arts, Germany

Software project management (SPM) and software quality management (SQM) are important aspects of software engineering. Unfortunately, these topics are fairly hard to teach to informatics students, mainly because they are very abstract and often seen as dull and boring by students. This contribution presents a didactical setting that the authors developed and used successfully for teaching SPM and SQM in a DisQspace format. A major aspect in the didactical setting lies on getting students actively involved and largely control their learning processes themselves. The paper presents the details of the approach, its didactical underpinning, and an evaluation of its efficacy.

Learning Electronics through Head, Heart and Hands

Authors: Gruhler, Gerhard; Fischer, Tim

Organisations: Heilbronn University, Germany

In this paper an approach is described which was practiced in the field of learning basic electronics for more than 10 years. The practicalities have been developed by trial and error as well as intensive discussions with the students. The paper focuses on (1) the learning strategy and learning environment and (2) the reflections on the background and goals for effective learning.

The described learning strategy is based mainly on problem-based learning and self-directed learning. The learning activity is guided by the 3H-Learning approach (Head, Heart and Hands). Special focus is also put on side-topics like: - Changing from Teacher to Trainer -Balancing the different aspects in the projects - Valueing the learning support by the peer group - Motivating the "engineer inside" instead of the pupil

This paper will help to open the "fences" around students which limit their inside motivation and energy and put them to an open learning environment..

Engaging on Entrepreneurship: The effectual logic behind the Entrepreneurship Journey

Authors: Tokunaga Contreras, Scarlett Nadir; Martinez Diaz, Mar; Crusat, Xavier

Organisations: KU Leuven, Belgium; InnoEnergy

Large incumbent firms represent the energy sector, portraying their entrepreneurs mostly as energy specialists on the field. In this context, a theoretical framework based upon expert entrepreneurs study is required to engage energy engineers in a logic of thinking, which leads towards entrepreneurial performance. The goal of this paper is to analyze how the Entrepreneurship Journey, an innovative learning methodology for developing entrepreneurship in the energy sector, uses the principles of the effectual theory. Effectual theory reveals an entrepreneurial reasoning based on industry expertise. The Entrepreneurship Journey takes place after the Innovation Journey that is based on real-life challenges by energy stakeholders. Those innovative learning methodologies are applied in the Energy for Smart Cities master program by KU Leuven for EIT InnoEnergy, which also generates a collaborative learning environment for making value generation possible (coo-petition). Three principles of the effectual theory are explored in this paper: strategic partnerships, leverage contingencies, and affordable loss; as drivers of entrepreneurial attitude. The Innovation and Entrepreneurship Journeys emphasizes aspects like taking action, value creation and employment of creative business tools, which reveal that an entrepreneurial expert logic can be taught and replicate in educational environments. A case-study methodology and 12 indepth interviews to teachers and alumni, who decided to follow an entrepreneurial trajectory, suggest this last as an engaging entrepreneurship learning to speed up entrepreneurial processes in the energy field.

Engagement in a mixed-method course: the case of Project Management

Authors: Henao, Alvin; Calle, Maria

Organisations: Universidad del Norte, Colombia

Engineers nowadays require knowledge about many topics to succeed in the workplace. The Project Management course provides tools to understand and plan projects in large scale, including financial topics. The course is usually taught in a theoretical manner, with the professor explaining concepts and the students developing homework and written exams. Student performance in the course was good, but engagement during the class was perceived to be very low. As a result, the professor decided to change the course and used three different methods: evidence based evaluation, project based learning and experiential learning. At the end of the semester, students took a NSSE (National Survey of Student Engagement) survey [1]. Results show student engagement in different activities performed during the class, favoring a mixed methods class over a traditional one. The methods employed supported analysis, synthesis and decision making by the students.

Fostering Questions in Class – How to create and maintain a learning environment that encourages students to ask questions

Authors: Thurner, Veronika; Hammer, Sabine

Organisations: Hochschule München, Germany

Many lecturers observe that students avoid asking questions in class. However,

asking questions is an important step within a student's learning process. Therefore, we aim to identify what we can do as lecturers to improve this issue. To achieve this, we sketch a general question-answer setting in class and elicit how dealing with this setting feeds back on the emotional base as well as on cognitive teaching and learning processes. As a next step, we identify aspects that are crucial success factors for generating positive learning outcomes in a typical question-answer setting. On this basis, we then discuss best practices that help to systematically generate these positive learning effects.

Experimenting with Engagement: an intervention to promote active reflection during laboratory practicals

Authors: Louw, Tobias Muller; Wolff, KarinOrganisations:Stellenbosch University,

South Africa

Laboratory experiments form an integral part of engineering education, providing a space in which students are given the opportunity to link theoretical concepts to real-world applications. However, students are often unable to engage in the experiments in a meaningful way as the underlying physical principles are not directly measurable but must be inferred through data analysis, even more so in the context of chemical engineering compared to the other engineering disciplines. In this work, Legitimation Code Theory was applied to investigate student learning in a typical chemical engineering laboratory module, both on the time-scale of individual experiments (analyzed in terms of the semantic plane) as well as over the course of the entire semester (analyzed in terms of the epistemic plane). The laboratory experiment as a translation device was considered and an intervention was proposed to enhance the efficacy thereof by providing laptops to facilitate instant data processing. The structure of the module provided a unique opportunity to effectively assess the impact of the intervention without unduly disadvantaging any participants. Quantitative empirical results confirmed that the intervention improved the learning opportunity provided by the laboratory experiment by ensuring that the underlying concepts become self-evident. Furthermore, it was established that students engaged more effectively with experiments when the underlying theory (ontic relations) are emphasized above the experimental approach (discursive relations).

(2F) Gamification tools and frameworks

Chairs: Utesch, Matthias

Room: 140 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-18 15:00

Towards the Improvement of ADHD Children through Augmented Reality Serious Games: Preliminary Results

Authors: Avila-Pesantez, Diego; Rivera, Luis; Vaca-Cardenas, Leticia; Aguayo, Stteffano; Zuniga, Lourdes

Organisations: San Marcos National University, Peru; Polytechic School of Chimborazo, Ecuador; North Fluminense State University, Brazil; San Marcos National University, Peru; Polytechic School of Chimborazo, Ecuador

Serious games have recently shown great potential to be adopted in the psychotherapeutic area. One critical challenge is developing serious games using emerging technologies like Augmented Reality (AR) focus on cognitivebehavioral therapies for children with mental disorders in school-age. This paper aims for improvement of ADHD children's attention to be trained using an Augmented Reality Serious Games (ARSG) prototype. This was designed with the help from experts, workshops with designers, guidance from psychologists and medical doctors specialized on ADHD, and by using a methodical game design approach along with natural user interface (Kinect). The findings of the study case showed that children increase in play-time, retention of player's attention, improvement the tolerance for frustration and persistence.

A methodology for gamifying of the educational process

Authors: Mozgaleva, Polina; Zamyatina, Oxana; Cabral, Pedro; Mozgaleva, Alena

Organisations: Tomsk Polytechnic University, Russian Federation; Tomsk State University, Russian Federation; NOVA IMS - Universidade Nova de Lisboa, Lisbon, Portugal

In this research study, the authors designed, proposed, tested, and partially researched a methodology for the gamification of academic disciplines through the example of the Elite Engineering Education (EEE) program in Tomsk Polytechnic University (TPU). Gamification implies augmenting the process of training in academic disciplines by introducing game elements that motivate students to gain new knowledge, develop their competencies, and, in the end, improve a university graduate's knowledge and skill levels.

Experiencing Musical Rhythm through Interactive Installation and AR/VR Game Development

Authors: Chung, Szu-Ming; Lin, Hui-Guan; Tsou, Tsai-Ling; Wu, Chun-Tsai; Huang, Chun-Hsiung

Organisations: Dept. of Digital Content Design, Ling Tung University, Taichung, Taiwan

To better perceive and internalize rhythmic feeling and understand its relation to musical ideas, and furthermore create music coping with visual production, this game development includes 3 stages of training, thinking/designing and creating, The stage I is to realize and feel the rhythm and pulsation through body movements with a device on foot stepping boards with a game interface on computer. On Stage II and III, a simple AR/VR simulation system offers basic ideas of rhythmic pattern related to melodic line through creating virtual instruments and improvising music on them.

Let's Learn With Kahoot!

Authors: Seralidou, Eleni; Douligeris, Christos; Gkotsiopoulos, Panagiotis

Organisations: University of Piraeus, Greece

Blended and computer supported collaborative learning (CSCL) are rapidly evolving fields, passing through many and lasting changes. Also, the use of digital games as a tool for teaching and learning is now considered a way to engage students and make classes more interesting. For example games like Kahoot! are an excellent choice for teaching university students. In this study we are exploiting Kahoot!'s supported features by implementing in the learning process the "quiz" and "jumble" types of games, within the "Web Technologies" workshop, that is taught in the University of Piraeus, settings. Also, we use the "challenge" feature to assign homework for further engagement. At the end we gather the students' opinions about this blended type of teaching and learning, by using suitably adjusted questionnaires, with results of great interest.

Computer Decision Simulation Games for Logistic Training of Engineers

Authors: Milosz, Marek; Milosz, Elzbieta

Organisations: Lublin University of Technology, Poland

Digital natives are now reaching universities. They change the approach to the learning process and its implementation. Serious computer games have become a regular part of engineering education in the digital environment. They have been included in the postgraduate study programme "Logistics Processes Management" for non-logistics specialists. This programme is the response to the growing demand for logistic specialists in Poland. It allows the acquisition of new knowledge and skills by engineers of other specialties in less time than the normal higher education cycle. Specially designed computer decision-making simulation games are intensively used in this programme. This article presents logistic games involving computer simulation and decision-making in three different areas: market and competitor analysis, supply chain processes, and activity based costing in logistic processes. The methodology of using the games during the didactic process is also presented. This methodology uses Kolb's Learning Cycles. It was developed on the basis of experience from the implementation of the postgraduate study programme.

Developing Gaming Activities for Conceptualising Aspects of Rate of Change

Authors: Avgerinos, Evgenios P.; Remoundou, Demetra

Organisations: Mathematics, Mathematics Education and Multimedia Laboratory, University of the Aegean, Rhodes, Greece

The "Rate of change" is used in everyday life and in different scientific contexts besides mathematics, such as physics, economics and engineering. Its various practical aspects, make rate of change stand as a bridge between theory and practice in mathematics education. Moreover, the understanding of the concept of "rate of change" is considered critical for the perception of other concepts of mathematics and especially in calculus [1].

The findings of researches on the understanding of rate of change indicate that although students can solve problems algorithmically, they have not conquered the concept [1]. As a result, the earlier introduction of the concept in the curriculum by an intuitive approach has been proposed [2].

In the current study, a game activity was designed, developed and evaluated, aiming to introduce an intuitive approach of aspects of rate of change. The developed activity intends to help pupils and even students understand the meaning of a rate and its properties, focusing on the impact of a decreasing rate, by a realistic situation, without formal definitions or calculations.

(2G) Knowledge and Competencies in Engineering Education

Chairs: Santos, Henrique

Room: 340 people plenary room with speaker and presidency table located in the basement at the right of the reception

Date and time: 2018-04-18 15:00

Study Motivation and Academic Emotions in Engineering Students

Authors: Fritzsche, Eva Susanne; Schlingensiepen, Joern; Kordts-Freudinger, Robert

Organisations: Technical University of Munich, Germany; University of Applied Science (TH) Ingolstadt, Germany; Paderborn University, Germany

Student dropout is an important topic, with dropout rates around 36 % being particularly relevant for engineering students. Universities need more knowledge about the determinants of finishing a study program without a degree. The paper assumes that motivation to study and current emotional states are highly important for achievement as well as for student retention. In a first attempt to investigate these aspects with engineering students, the paper investigates relations between motivations to study, emotions, and the self-reported achievement. The results indicate that emotions, selfefficacy and subscales of motivation explain variance in student achievement, supporting the importance of these aspects.

Towards the construction of a questionnaire for the identification of learning obstacles

Authors: Reuter, Rebecca; Hauser, Florian; Gold-Veerkamp, Carolin; Stark, Theresa; Kis, Juliane; Mottok, Jürgen; Abke, Jörg; Meyer, Dany

Organisations: OTH Regensburg, Germany; University of Applied Sciences Aschaffenburg, Germany; University of Regensburg, Germany; University of Applied Sciences Neu-Ulm, Germany

To improve current learning settings, especially for software engineering courses, it is important to show an interest in students' needs and their obstacles while learning.

This paper deals with the identification of learning obstacles in two iterations using the questionnaire method: The first one was part of a survey that was carried out at four locations at universities of applied sciences.

In a second step, we use the "Motivated Strategies for Learning Questionnaire" which was developed by Pintrich as a basis to develop a questionnaire that extracts learning obstacles. In its original version, the MSLQ was intended to measure students' learning strategies, but as the obstacle dimensions were partly derived from learning strategy classification we chose this already validated questionnaire.

This paper contributes with insights regarding the structure and generation of a questionnaire that extracts learning obstacles in general and with special focus on epistemological ones for software engineering courses.

The order of skills development for a technician and a technologist training curriculum

Authors: Gqibani, Samuel; Nel, Andre; Clarke, Norah

Organisations: University of Johannesburg, South Africa

The Department of Mechanical Engineering Technology at the University of Johannesburg (UJ) is offering a National Diploma (NDip) and a Bachelor of Engineering Technology (BEngTech). The National Diploma is a qualification that is aimed at training technicians while the BEngTech is for training technologists. During the first year of study of both qualifications, students are taught Mechanical Engineering Drawing and Mechanical Engineering Manufacturing. Mechanical Engineering Manufacturing has a handskills project where students are required to use basic tools to make a component (like a file, hacksaw, engineers square, taps and so on). Students are expected to read, interpret and understand the drawing so that they can be able to produce the required product. The skills of understanding a drawing are taught in the Mechanical

Engineering Drawing module. The National Diploma students are taught drawing and manufacturing simultaneous, so they do the handskills project while doing drawing. While the BEngTech students learn drawing in the first semester and then do the handskills project during the second semester. The BEngTech curriculum is designed such that drawing prepares students for the handskills project that will follow in the second semester. This paper is exploring the benefits of designing a curriculum such that knowledge is taught to the students at the appropriate time. A qualitative research method is used where students and lab technicians are interviewed. From data gathered, the NDip students alluded to the fact that lab technicians had to teach them how to read and interpret a drawing. The BEngTech students had a clear advantage. They understood the project because they were better prepared in the drawing class. Lab technicians felt that the BEngTech students produced a better product and were fully prepared for the task.

Development of Intercultural Competences of Students in Engineering Disciplines

Authors: Poulova, Petra; Cerna, Miloslava

Organisations: University of Hradec Králové, Czech Republic

Various mobility programs form an inseparable part of modern university studies. Those mobility programs are both intersector and international ones. International stays in foreign countries are organized as internships or study stays. The aim of intersector and international stays is to gain new experience, practical skills, and to widen a specific relatively narrow academic perspective. This paper shows new approaches to incorporate international experiences into higher engineering education. First, it analyzes the current situation of international student mobility, before emphasizing the general motivation for international student exchange

An Industry - Academia Model for Research

Authors: Bustamante, Rogelio; Izquierdo, Javier; Ramirez-Mendoza, Ricardo A.

Organisations: Tecnologico de Monterrey, Mexico

This study presents a simple projectized organization used in the Research Center on Microsystems and Biodesign at Tecnologico de Monterrey. The proposed work model aims to increase the interaction between undergraduate and postgraduate students in a projectmanagement based industrial model applied to research. The main purpose of this study is to demonstrate how this organizational structure helps to increase innovation, speed-up research, and increase the students' skills. The roles assigned to students and advisors in multidisciplinary groups create a synergic interaction among members that allows for an interruption-free working environment. The strengths of this model and the methodology to implement it are presented. The model adds value to the curricula and helps to comply with the metrics established by national and international accreditation institutions. Knowledge transfer is an important aspect in the development of projects because of the high turnover rate in academia during the development of global products. Therefore, it is important to avoid repetitive tasks to save time. The implementation of this model has provided the development of functional prototypes, the graduation of participating students with project management experience, and a global increase in scientific production.

(3A) Collaborative work and Technologies for Engineering Education

Chairs: Sabitzer, Barbara

Room: 50 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-18 16:30

Work in Progress: Contributing to becoming aware of the value of Open Education

Authors: Tovar, Edmundo; Martin, Sergio; Llamas, Martin; Caeiro, Manuel; Martinez Bonastre, Oscar; Strachan, Rebeca; Castro, Manuel

Organisations: Universidad Politécnica de Madrid, Spain; UNED; Universidad de Vigo; Universidad Miguel Hernández; Northumbria University

This paper shows the design, approach and first collection of data of the MOOC "Foundations to Open Education and OERs repositories". This is the first MOOC of the IEEE Education Society, and it has been delivered freely and open available through IEEEx, a channel of edX.

The Students' Perspective on Mixed Reality in Higher Education. A Status and Requirement Analysis

Authors: Willicks, Freya; Stehling, Valerie; Richert, Anja; Isenhardt, Ingrid

Organisations: *IMA/ZLW* der *RWTH Aachen, Germany*

The twenty-first century is highly influenced by digitalization and rapid technology advances. Deriving from these trends, the evolution of Virtual and Mixed Reality worlds is a further development. Mixed Reality (MR) in this context "describes the combination of virtual environments and natural user interfaces" [1, p. 407].

With the emergence of studies showing that the use of Virtual and Mixed Reality elements in learning processes positively influence the students' motivation and their control of learning-outcomes, these technologies are becoming more and more popular practices in education and learning contexts [2,3,4]. Nevertheless, studies about the students' perspective in Germany are rarely conducted. Therefore, a status and requirement analysis of the students' demands on MR in higher education has been developed and conducted. Questions of research are composed of the students' general attitude towards MR in higher education and the influence of user factors on their attitude. Furthermore, the study covers the participants' perception of the current usage of MR in higher education.

The PACE experience: Global Collaborative Engineering Course and Global Projects

Authors: Orta, Pedro; Ahuett, Horacio; Ramirez-Mendoza, Ricardo A.

Organisations: Tecnologico de Monterrey, Mexico

Since 2004 we have been working with the universities in the USA, Canada, Mexico, Germany, Brazil, Korea and China developing different projects. Some of them with a large number of team members and universities. In some cases, we had worked with small teams, which are more easy to manage.

Some challenges that we had found in these projects are related to the communication and cultural issues. Although we define English as our communication language sometimes, communication is difficult for the students since they do not have all proficiency in English and communication is difficult, and there are misunderstandings. Another challenge found in this projects is the cultural diversity, as an example students from Mexico and Germany have different meanings for punctuality, these differences create problems between team members. Also, Differences in academic calendars are other problem, schools start and end at different dates and months. China and Europe have different schedules than USA or Mexico. In this section, we intend to present more detail on these projects.

Discovery of potential collaboration networks from open knowledge sources

Authors: Chicaiza, Janneth; Piedra, Nelson; López, Jorge; Tovar, Edmundo

Organisations: Universidad Técnica Particular de Loja, Ecuador; Universidad Politécnica de Madrid, Spain

Scientific publishing conveys the outputs of an academic or research activity, in this sense, it also reflects the efforts and issues in which people engage. The achievements made from academic and scientific work can help organizations to lead better resources management where they invest and can help researchers to find peers or networks with whom to share development of a particular line of work. In this paper, the second topic is tackled.

To identify potential collaborative networks one of the simplest approaches is to leverage the co-authorship relations. Traditional methods applied to detect collaborative networks don't use open sources of knowledge. Semantic and hierarchic relationships defined by a Knowledge Organization System (KOS) can help improve the system's ability to recommend potential networks beyond the lexical or syntactic analysis of the topics or concepts that are of interest to academics.

In this paper, this issue is undertaken through the semantic enrichment of the concepts associated with scholarly production. Open KOSs published under Linked Data Design Issues are used to find hidden or implicit relations between concepts that two researchers may be interested, so it is possible to identify potential collaboration communities. An inference mechanism based-on semantic relationship is enabled to discover communities that share the interest in a particular topic.

The proposal was validated with a subset of Scopus' papers with at least one author of any Ecuadorian affiliation. The analysis disclosed some features of the structure of the collaborative networks between authors, institutions and involved countries. Also, through the enrichment of concepts, main issues on which the researcher's work was discovered.

Experimenting in PILAR Federation: a Common Path for the Future

Authors: Garcia-Loro, Felix; Macho, Alejandro; San Cristobal, Elio; Diaz, Gabriel; Castro, Manuel; Kulesza, Włodek; Gustavsson, Ingvar; Nilsson, Kristian; Fidalgo, Andre; Alves, Gustavo; Marques, Arcelina; Hernandez-Jayo, Unai; Garcia-Zubia, Javier; Kreiter, Christian; Oros, Ramona; Pester, Andreas; Garbi-Zutin, Danilo; Auer, Michael; Garcia-Hernandez, Carla; Tavio, Ricardo; Valtonen, Kati; Lehtikangas, Elina

Organisations: UNED, Spain; BTH, Sweden; IPP, Portugal; UDEUSTO, Spain; CUAS, Austria; IAOE, Austria; EVM, Spain; OMNIA, Finland

PILAR (Platform Integration of Laboratories based on the Architecture of visiR) Erasmus Plus project development started in September 2016 and will last three years. The core of PILAR project is VISIR remote laboratory — Virtual Instruments System In Reality—. The project aims for a federation of five of the existing VISIR nodes, sharing experiments, capacity and resources among partners, and to provide access to VISIR remote lab, through PILAR consortium, to students from other educational institutions.

PILAR will be the framework from which management tasks will be performed and laboratories/experiments will be shared. PILAR will also foster the Special Interest Group of VISIR under the Global Online Laboratory Consortium (GOLC) of the International Association of Online Engineering (IAOE).

Work in Progress: Communication Challenges in International Education

Authors: Zilora, Stephen J.; Žagar, Martin; Raza, Ali

Organisations: *RIT*, *NY*, *USA*; *RIT Croatia*, *Croatia*; *RIT Dubai*, *Dubai*, *U.A.E*

Distance and collaborative education has many potential benefits, most notably is the ability to overcome the temporal and spatial restrictions of traditional educational settings, but changes in general communication processes between educators and students, educators themselves and students themselves are also predominant. With both business and personal life becoming more collaborative and less geo-centric (examples of social networks like Facebook or LinkedIn, or collaborative economy like Uber or Airbnb), the authors' institution, along with its international campuses in Europe and the Middle East, is setting a new level of distance and collaborative education that enables students form different cultures and time-zones to work together on real projects in a controlled, academic setting, but in a manner that mirrors business and industry projects to a very high degree. Three instructors and more than 50 students are working jointly on the same projects and relying greatly on effective communication. In this work, the authors address and describe their experiences and challenges in communication and collaborative education from both their perspective and the students' perspective. The main intention is to make the educational process more efficient and to introduce more interaction between the students and their teachers, who act more as project advisors.

(3B) Systems and Technologies for Learning

Chairs: AbuShanab, Shatha

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-18 16:30

Conception of a LEGO® Mindstorms EV3 Simulation for Programming in C

Authors: Haak, Valentin; Abke, Jörg; Borgeest, Kai

Organisations: University of Applied Sciences Aschaffenburg, Germany

Based on the didactical concept that was developed to integrate a robot-platform into teaching and learning of Computer Science in engineering courses at the university of Applied Sciences Aschaffenburg the Lego Mindsorms EV3 [1] robots were integrated into the practical lessons. In these Computer Science lessons the students (Bachelor of Engineering) learn the programming-language ANSI C. To program the robots in this language a dedicated toolchain [2] was developed. A major problem that was mentioned many times in a regular semester evaluation, after integrating the EV3, is the fact that the students cannot use the robots outside of the laboratory. So they are not able to learn and program the EV3 independently from the laboratory opening hours and practical lessons. To solve this problem and improve the success with this platform, it will now be analysed if a simulation could advance the process of deepening the learned skills in practical and theoretical computer science lessons. Also a concept for the realisation of such a simulation will be shown. This will be done based on the developed didactical concept for integrating a robot-platform in teaching and learning of Computer Science in engineering courses [3].

Aligning Student and Educator Capstone Project Preferences Algorithmically

Authors: Greeff, Jacob Jacobus; Heymann, Reolyn; Nel, Andre Leon; Carroll, Johnson

Organisations: North-West University, South Africa; University of Johannesburg, South Africa

This paper reviews recent attempts by researchers at the University of Johannesburg to increase the level of engagement experienced by students in a final year capstone project by allowing for a greater level of autonomy in project selection and assignment.

The text introduces the context, followed by a justification from current literature on the approach taken, introduction to the approach and finally a summary of the outcomes obtained by the project. In this study an authentic learning approach was followed which allowed students to propose and tender for capstone projects in a BEng course, and following a period of tender also give active input into the selection of tenders based on their personal knowledge as engineers. From this process, a preference list was obtained from both students and faculty on their opinions of the best way assignments can happen, and following this a Gale-Shapley algorithm was employed to attempt to select the optimal assignment of projects to students. It is hoped that this study will inspire other educators in similar situations to consider handing over some measure of control to students during their undergraduate studies in engineering to increase the level of responsibility and thoughtful reflection experienced by students before they enter the profession.

The use of WhatsApp in design-based modules

Authors: Hertzog, Pierre Eduard; Swart, Arthur James

Organisations: Central University of Technology, Free State (CUT), South Africa

WhatsApp is used by 1.2 billion users worldwide. This social media platform is also used as an educational tool and has been the focus of many studies in higher education. WhatsApp was used as an educational tool to improve communication, to promote student engagement and to provide better student support in two design-based modules, namely Projects II and Design Project III, at the Central University of Technology (CUT) in South Africa. The purpose of this paper is to present a case study with descriptive statistics of quantitative data regarding student perceptions on the use of WhatsApp in these design-based modules. Student perceptions are important when new technologies are introduced and can be used to assess such teaching innovations. The research question thus arises, what are the perceived advantages and disadvantages of using WhatsApp in design-based modules at CUT? The results suggest that students have a generally positive view of WhatsApp as an educational tool that helps them to connect with others and collect information in a quicker and easier fashion (these are identified advantages). Disadvantages, listed by a minority of respondents, included the cost of airtime in South Africa, limited bandwidth and being distracted by using WhatsApp for other purposes. Although this study has focused on the use of WhatsApp in design-based modules, it will be interesting to investigate the use of several social media platforms over a range of modules offered at CUT.

Quantifying the impact of a new SoTL programme in Engineering Education at a University of Technology in South Africa

Authors: Swart, Arthur James

Organisations: Central University of Technology, South Africa

A drive towards the establishment of vari-

ous Scholarship of Teaching and Learning programmes at institutions of higher learning have been observed over the past decade. The primary aim of such programmes is to improve the teaching and learning process, which may be achieved by using the SoTL unicycle metaphor. The objectives of this unicycle are twofold: first, it outlines the process that academics need to engage in on a regular basis within a SoTL programme; second, it may create awareness among non-participating academics of what such SoTL programmes really entails. The research question arises "What impact has the introduction of a SoTL programme in 2014 made on faculty members in Engineering Education at a University of Technology in South Africa? The purpose of this paper is to quantify this impact by focusing primarily on the publications of the members which forms one of the spokes of the SoTL unicycle. Quantifying the impact of SoTL programmes involve considering many variables that are discussed in the paper. The discussions are grounded in the humanistic theoretical framework which asserts that learning about one's practice is a personal act in order to change one's own perceptions and actions. A case study is used with quantitative data. Results indicate that, on average, for every three academics that join the programme, one leaves within a year. However, the academics who stuck with the programme since 2014 where able to increase their publication research outputs, with one staff member achieving nine peer-reviewed full conference papers and one accredited journal article over a three-year period. It is recommended that at least one faculty member from each department be represented in the SoTL programme, that will lead to more awareness being created among other departmental members of the impact and meaning of such programmes.

The Impact of Video Clips on Teaching in Technical Study Programs – Learning Faster or Learning Desaster?

Authors: Großkreutz, Damian; Logofatu, Doina; Schott, Anna

Organisations: Frankfurt University of Applied Sciences, Germany

Video-sharing websites like YouTube are very popular, their usage can particularly be seen by younger people, the so called "Digital Natives". For example about a billion of people visit YouTube every month and about a billion of hours is spent there daily to watch videos. This enthusiasm for videos in principle offers the opportunity to use them as a didactical tool. But even the medium is available since decades the usage of videos in didactics is still an expandable field and scientific publications are drawing a very complex scheme on this topic. Quantitative findings of the effect in teaching are very rare. Therefore a project team at the Frankfurt University of Applied Sciences carried out a project to analyze the situation and define strategies for the own needs focusing on the engineering subject of study "manufacturing technology".

Based on literature and own considerations a questionnaire was designed asking for preferences in learning media comparing chalkboard, powerpoint and video based lectures. In parallel around 900 written examinations were analyzed over a period of 7 years. The analysis compared examination results on topics which were taught by video clips to results on topics which were taught in powerpoint and chalkboard lectures. The results in numbers did not show a significant advantage by video teaching but gave interesting hints for follow-up projects. Regarding the different didactic tools a clear preference could be found for video based lectures. Notable was that female students tended a little to the chalkboard lectures.

Blended learning and Pedagogical Evolution Toolbox - examples from Clean Fossil and Alternetive Fuels Energy – Innoenergy MSc Program

Authors: Pikoń, Krzysztof; Bogacka, Magdalena; Czop, Monika

Organisations: Silesian University of Technology, Poland

Clean Fossil and Alternative Fuels Energy is one of 7 programs of Innoenergy Master School. The program construction is based on international network of Innoenergy. Innoenergy is an organization which aims at changing the education towards strengthening entrepreneurial and innovative potential in European universities. The structure of the program is based on innovative approach of multidimensional blended learning. The expert knowledge is accompanied by shaping behavioural skills and competencies like presentation skills, problem solving, teamwork, leadership in order to culture students of high level capabilities and high innovative potential. In addition the competencies in business and management are delivered as well. The program include activities strengthening entrepreneurial potential. The program is in large part practical and based on active learning methods. This includes internships, study visits, participation in challenge projects. Additionally new pedagogical methods are implemented – like case teaching. The program was developed taking into account the current requirements of the labour market and it provides students with knowledge in a communicative way, to teach them how to bring together facts, show connection with real life. The whole program is shaped with extensive support from industrial partners and is based on learning outcomes approach and additionally Overarching Learning Outcome by EIT. The special OLOs evaluation system was introduced. The 6 years of program execution proved that the concept is efficient and delivers significant results.

(3C) Data and Learning in Engineering Education

Chairs: Preciado Babb, A. Paulino

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-18 16:30

New Factors to Predict Dropout at the Universities:A case of study in Ecuador

Authors: Alban, Mayra; Mauricio, David

Organisations: Technical University of Cotopaxi; State University of San Marcos; State University of San Marcos

The dropout at the universities has become a concern in several countries around the world. Based on the analysis of the educative and organizational theories, and the logic reasoning were established 11 factors that influence in the dropout. The present research as an objective to design a model to determine new factors to predict the dropout in which the dimension of analysis included were the students, the institutions, the academic context and the social and economic environment. Additionally, test through the use of Logistical Regression, Decision Tree and Support Vector Machine if the proposed factors are related and or may to contribuite for predicting the dropout at the universities of Ecuador.

Workplace Learning Analytics in Higher Engineering Education

Authors: van der Stappen, Esther

Organisations: *HU University of Applied Sciences Utrecht, The Netherlands*

Learning in the workplace is crucial in higher engineering education, since it allows students to transfer knowledge and skills from university to professional engineering practice. Workplace learning can have different representations, the most common being internships, work placements and traineeships. Many (professional) Bachelor programs, especially those at universities of applied sciences, have integrated some form of workplace learning in their curricula. Learning analytics is defined as "the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environment in which it occurs". Learning analytics endeavors in higher education have primarily focused on classroombased learning. Recently, workplace learning analytics has become an emergent research area, with target users being workers, students and trainers. The field of workplace learning analytics is still in an early stage of development and the number of contributions is relatively small. We present a new type of technology for workplace learning analytics that allows program managers of higher engineering education programs to get insight into the workplace learning of their students, while ensuring privacy of students' personal data by design. Using a design-based agile methodology, we designed and developed a customizable workplace learning dashboard. From the evaluation with program managers in the computing domain, we can conclude that such technology is feasible and promising. Program managers use the dashboard as an exploratory tool to check preconceived opinions on workplace learning and to evaluate the alignment between workplace learning assessment criteria and the actual conducted activities in workplace learning. The proposed technology was designed to be generalizable to other engineering domains. A next logical step would be to evaluate and improve the proposed technology within other engineering domains.

Using Hyperdata in a Laboratory of Electronics

Authors: Sánchez-Azqueta, Carlos; Gimeno, Cecilia; Celma, Santiago; Cascarosa, Esther; Aldea, Concepción

Organisations: Universidad de Zaragoza, Zaragoza, Spain; Université catholique de Louvain, Louvain-la-Neuve, Belgium

The evolution of education is associated with the incorporation of information and communication technologies, as it can be inferred from the different strategies adopted at all levels of education. Another tool available for teaching innovation is augmented reality, which allows the combination of digital and physical information in real time, using different technological devices. A key advantage brought by augmented reality to the field of education is that it offers contextualized information, where and when the student needs it, which significantly enriches the learning process. A QR code (Quick Response) is a system that stores and provides a quick access to information. In this work, we propose the use of QR codes as a complementary educational resource to carry out laboratory sessions in the field of Electronics, aiming at improving the learning process of experimental skills. In this respect, a set of QR codes are generated to be used in the laboratory sessions to achieve a more efficient use of the time spent and a more meaningful learning. Two types of QR codes are developed: ones that are placed directly on the instrumentation used in the development of the practice, which contain hyperlinks to manuals, data sheets, etc., with the goal of facilitating the consultation of information regarding the operation and management of the instrumentation required in the laboratory; and others that appear in the documentation of the practice, and through them they have access to some demos on the measurement of parameters in the most complex steps of the development of the practice. This allows a better use of the time in the laboratory improving their instrumental skills and allowing the student to focus on the

analysis of the results and their relationship with the theoretical framework.

Methodology for Systematic Literature Review applied to Engineering and Education

Authors: Torres-Carrion, Pablo; González-González, Carina Soledad; Aciar, Silvana; Rodríguez-Morales, Germania

Organisations: Universidad Tecnica Particular de Loja, Ecuador; Universidad de la Laguna, España; Universidad Nacional de San Juan, Argentina

A systematic review of the scientific literature in a specific area is important for identifying research questions, as well as for justifying future research in said area. This process is complex for beginners in scientific research, especially if you have not developed skills for searching and filtering information, and do not know which high-level databases are relevant in their field of study. The method proposed leads the researcher from "My" to "The" current state of the problem; we propose an adaptation of the method by Kitchenham and Bacca, which divides the process into three sub-parts: planning, conducting and reporting results. From the approach of the research problem in the preliminary phase research questions (recommended between 3 to 5) and "mentefacto conceptual" is drawn; this last one gives originality to the method and facilitates the development of the thesaurus for searches and inclusion and exclusion criteria. Early research requires doing a basic systematic study to identify work done to review the literature in the area and, if any is found, to verify if those results yield an answer to our research questions. As part of planning the search process, general and specific inclusion and exclusion criteria were defined, along with some complementary inclusion and exclusion parameters. The method followed with rigor, returns to the researcher a list of impact journals in the study area, and a detail of articles that are related to each category of the research questions. A study case has been considered as a guide to expose each of the phases of the methodology in a practical way, with results that support the proposal.

Increasing Interactivity and Collaborativeness in MOOCs: A Pedagogical Solution to meet 21st century goals

Authors: Gamage, Dilrukshi; Perera, Indika; Fernando, Shantha

Organisations: University of Moratuwa, Sri Lanka

Massive Open Online Courses (MOOCs) are education technologies which capable of teaching thousands of students synchronously. The pedagogy in MOOCs are focus on decentralized learners where students watch videos, take quizzes, submit assignments and discuss using forums. This pedagogy is focusing on the didactic method of teaching. However, the students in 21st century are more connected and networked to learn effectively. Present and future workforce require critical thinking, communication, collaborative and creative skills, yet MOOC pedagogy does not support to upskill the required. This research introduces a facilitator driven group learning pedagogy inspired by cMOOCs. Pedagogies behind 7 different MOOC platforms were analyzed to understand existing models. Surveyed literature on empirical research of MOOCs success factors in order to propose and conceptually design the model "GroupMOOC". This will increase the student interactivity, provide a medium where they can collaborate and be creative. The paper explains the detail design goals and analogies behind features.

Integrated Assessment of Course and Program Learning Outcomes for Accreditation Process

Authors: Marey, Mohamed Fawzy; Mansour, Yasser El-Husseini Ibrahim; Sancristobal, Elio **Organisations:** Prince Sultan University, Saudi Arabia; Menoufia University, Faculty of Electronic Engineering; Prince Sultan University, Saudi Arabia; Zagazig University, Structural Engineering Department; UNED, Spain

One of the significant aspects of quality assurance of learning and teaching in higher education is the assessment of the course learning outcomes (CLOs) and program learning outcomes (PLOs). This assessment ensures achieving the intended developmental goals and protects the quality of education delivered to students from falling down.

The aim of this study is to develop a methodology to assess the CLOs and PLOs for Communications and Networking program. A course of information theory and coding is chosen as a case study in this paper to illustrate the proposed methodology. Our attention also focuses on developing a rubric which employs to precisely define students' expectations. In addition, a mapping between the CLOs and PLOs is introduced. Moreover, indirect assessment is also used. The proposed methodology is general in a sense that it can be applied in any engineering program.

The results are used for corrective decisions to be taken on both course and program levels to assure the best delivery of education.

(3D) Project and Problem base Learning

Chairs: Barada, Hassan

Room: 50 people, theater style, 3 people presidency table, video projector and computer, area mezzanine up of the conference center

Date and time: 2018-04-18 16:30

Enriching engineering education with didactics of mathematics

Authors: Florensa, Ignasi; Bosch, Marianna; Gascón, Josep **Organisations:** EUSS-Univ. Autònoma de Barcelona, Spain; IQS School of Management - Univ. Ramon Llull, Spain; Univ. Autònoma de Barcelona, Spain

Project Based Learning in Engineering Education is still facing challenges in research. Two of these challenges are the systematization of the construction and selection of the project and the lack of tools allowing to manage generated knowledge. We hypothesize that a methodology (didactical engineering) and an epistemological tool (Question – Answer maps) with its origins in didactics of mathematics can be applied in engineering education in order to partially overcome these issues.

We present the design, analysis and experimentation of two exploratory case studies in a General Elasticity course in the 3rd year of a Mechanical Engineering Degree in an Engineering School in Barcelona. The results seem to validate the initial hypothesis and reveal that didactical engineering and Question-Answer maps can be successfully applied under certain conditions in Engineering Education.

Agile Projects to Foster Cooperative Learning in Heterogeneous Classes

Authors: Kastl, Petra; Romeike, Ralf

Organisations: Friedrich-Alexander Universität Erlangen-Nürnberg, Germany

Teaching programming novices in secondary education is often described as a challenge, because student groups are often quite heterogeneous. Teachers react with special methods e.g. with individualized teaching, group work or project-based learning. As such a method for computer science education, that supports project-based learning agile projects are being discussed more recently. In the context of a design-based research work, experienced teachers have adapted and applied a theory-derived agile model in a wide range of contexts. In this qualitative case-study, we analyze 11 interviews with 6 teachers on their observations from 20 agile projects with over 400 students. The aim is to gain insight into how agile practices and artifacts assist individual learning processes and how they help teachers to design and organize agile projects in order to support students individually. A structured content analysis shows that agile teams face similar obstacles as teams in plan-driven projects, but that they can overcome them better in agile projects. Additionally, the analysis indicates that in agile projects the quantity and quality of interactions increases, which has positive effects on the construction of sustainable skills and that students furthermore are frequently involved in feedback processes and reflections, which makes their learning more goaloriented. Moreover, the data shows that teachers can identify their students' strengths and weaknesses better and also observe their individual learning processes better throughout agile project. Based on that knowledge they can design their agile project in a way that each student is challenged systematically and purposefully.

Capstone-based mentoring and the acquisition of professional skills.

Authors: Bermudez, Alejandro Jose; Pacheco, Alfredo; Izquierdo, Dennis; Ugalde, Franklin

Organisations: *TECSUP*, *Peru; UTN. Costa Rica.*

Our educational innovation is based on the "Triple Helix" Model that demonstrates the effectiveness and efficiency of the Capstone Project applied in the Industry, for the acquisition of professional skills in 6th - cycle in TEC-SUP (Higher Technological - Peru) and that could be replicated in institutions of higher education according to their own characteristics. We focus on ensuring the competitiveness of future graduates in the global labor market by planning and executing activities where the student will have the opportunity to meet hours of end-of-career practice in flexible hours, assisted by an academic mentor (professor), with the assignment of hours of accompaniment in the internship and support the presence of the institution in the companies. We incorporate an industrial mentor assigned by the companies, which will provide business orientation to the students, in problems of industrial interest. It is intended that these put into practice and consolidate their soft skills as well as skills and abilities in both verbal and non-verbal communication, being able to establish relationships between what has been learned in the institution and the execution of such learning in the labor field; this will allow them to design projects of social impact to culminate and present thesis.

Student Perceptions of the Use of Project-Based Learning in Civil Engineering Courses

Authors: El-Maaddawy, Tamer; El-Hassan, Hilal; Al Jassmi, Hamad

Organisations: UAE University, United Arab Emirates

Project-based learning (PBL) is a studentcentered approach in which students learn by solving real-life problems in a teamwork environment. Little is known about how students in different academic levels perceive the effectiveness of PBL approach. This study aims to compare and analyze students' perceptions of the use of PBL in different undergraduate- and graduate-level civil engineering courses. Students' perceptions of the effectiveness of the partial use of PBL in civil engineering courses to improve their understanding of course topics and develop their life skills were collected through a questionnaire distributed at the end of the semester. Data was collected from 104 students enrolled in five different undergraduate and graduate civil engineering courses. Results showed that students of the junior-level course held more positive attitude towards collaboration and teamwork rather than students of senior-level or graduate-level courses. The mean scores of the survey questions related to

teamwork, collaboration, and communication skills tended to decrease with an increase in the course level. Junior-level students exhibited the highest degree of satisfaction in response to the survey question related to the degree of enjoyment when working in groups. Due to the difficulty in scheduling meetings, ineffective communications were noted by graduate students. They recorded the lowest mean scores for the survey questions related to teamwork/collaboration skills and degree of enjoyment when working in groups. Survey results indicated, however, that PBL was more effective in improving understanding of course topics, self-regulation and self-learning skills of the graduate students rather than undergraduate students.

A Project-based Learning Design for Teaching and Learning of Mechatronics Engineering

Authors: Nieh, Tsung Hsuan; Chou, Jui Jen

Organisations: National Taiwan University, Taiwan; National Taiwan University, Taiwan; National Ilan University, Taiwan

This article aims to design a richly educational, project-based teaching and learning riderless bicycle scenario. The riderless bicycle scenario is not only close to students' lives and rich in a large number of theoretical and practical research topics but also integrates mechatronics engineering subjects from the freshman year to the senior year. Through a series of courses, students are allowed to have projectbased learning in this scenario so as to cultivate the necessary professional knowledge and core competencies for entering the industry in the future. The series of courses include the introduction, in-depth, and transformation courses. The introduction courses guide students about the scenario and establish their framework relation and basic understanding about the various subjects of mechatronics engineering. The in-depth courses allow the students to gradually design and actually fabricate the riderless

bicycle. During the process, they can study and integrate the various subjects and disciplines in depth as well as develop independent learning, innovative thinking, problemsolving, teamwork, and communication skills and other core competencies. The transformation courses help the students internalize their knowledge and experience in the scenario, translating them into other practical applications and connecting with the industry. This study designed a learning workshop for actual implementation and conducted a survey afterward on to make a preliminary assessment of the feasibility and learning outcomes of the riderless bicycle as a project-based learning and teaching scenario and to collect feedback from students to serve as the reference for the design and improvement of follow-up curriculum series.

Implementation of case study method as an effective teaching tool in engineering education

Authors: Zuwała, Jarosław

Organisations: AGH University of Science and Technology, Poland

KIC Innoenergy M.Sc. "Clean Fossil and Alternative Fuels Energy" course gives students an unique offer of studying subjects related to fuels and energy, combined with gaining the entrepreneurial skills and focused on innovative thinking This blend gives a perfect blend of engineering knowledge and project management skills. However, current job market puts the emphasis on graduates' skills such as critical thinking, insight, and analysis capabilities, including experiential learning that gives prominence to soft skills - such as the ability to collaborate, work in groups, read social cues and respond adaptively".

To approach this and in the end to give students the possibility to gain the required abilities, traditional teaching methods based on lectures and individual one-for-term projects should have to be gradually replaced by case study teaching. Even though they were primarily developed in business and law contexts, nowadays it is strongly postulated that they can be very productively used also in teaching engineering subjects.

This paper presents first the methodology of building exemplary engineering case studies which are then illustrated by a complete example of a case, created fully by the Author and implemented during his classes.

The presented case study entitled is based on a short scenario and on the questions "What would you do now?". It has been assigned as a teamwork so that participants are able to brainstorm and develop common solutions, but they can also be used as an individual assignment. Main three basic components of a case study are illustrated: a real world background and data & fictive scenario, real world documentation & data and an open-ended problem to be solved by the students.

The most common bottlenecks of preparing an interesting case – study are also illustrated and the discussion is given of how to overcome them.

(3E) Active learning and Active Methodologies

Chairs: Yousafzai, Jibran Khan

Room: 60 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-18 16:30

Pilot experience applying an active learning methodology in a Software Engineering classroom

Authors: García-Holgado, Alicia; García-Peñalvo, Francisco José; Rodríguez-Conde, María José

Organisations: *GRIAL Research Group, University of Salamanca, Spain*

Software Engineering I is a mandatory subject for undergraduate students that is taught in the second semester of the 2nd year of the Degree in Computer Sciences at the University of Salamanca (Spain). This degree exists since 1989 but it has transformed over time according to the education law changes in Spain and Europe. Software Engineering I is the first subject related to the area of software engineering that is taught in the degree. The novelty of the concepts and the need to develop abstract thinking to acquire the different competences of the subject, implies a handicap to teach the subject. The final grades obtained by the students in the subject are fairly low compared with other subjects in the degree. Moreover, the attendance to the faceto-face classes is continuously reduced throughout the semester, which affects to the continuous assessment. Some initiatives have been applied during previous school years but a global change of the subject is necessary. In order to increase the success rate of the subject and to achieve that students are involved in the learning process, authors have implemented an active learning methodology based on team working. Furthermore, two instruments have defined to measure the impact of the changes and evaluate the pilot.

Enhance Learning in a Video Lecture Archive with Annotations

Authors: Malchow, Martin; Bauer, Matthias; Meinel, Christoph

Organisations: Hasso Plattner Institute, Germany

When students watch learning videos online, they usually need to watch several hours of video content. In the end, not every minute of a video is relevant for the exam. Additionally, students need to add notes to clarify issues of a lecture. There are several possibilities to enhance the metadata of a video, e.g. a typical way to add user-specific information to an online video is a comment functionality, which allows users to share their thoughts and questions with the public. In contrast to common video material which can be found online, lecture videos are used for exam preparation. Due to this difference, the idea comes up to annotate lecture videos with markers and personal notes for a better understanding of the taught content. Especially, students learning for an exam use their notes to refresh their memories. To ease this learning method with lecture videos, we introduce the annotation feature in our video lecture archive. This functionality supports the students with keeping track of their thoughts by providing an intuitive interface to easily add, modify or remove their ideas. This annotation function is integrated in the video player. Hence, scrolling to a separate annotation area on the website is not necessary. Furthermore, the annotated notes can be exported together with the slide content to a PDF file, which can then be printed easily. Lecture video annotations support and motivate students to learn and watch videos from an E-Learning video archive.

Implementation of Active Learning Method in Transportation Engineering Seminar Course: Case Study at San Diego State University

Authors: Ghanipoor Machiani, Sahar; Mladenovic, Milos

Organisations: San Diego State University, USA; Aalto University, Finland

The challenges of retiring workforce, attracting new students, and high educational requirements for dealing with transportation systems complexities have been highlighted in the past decades. In response, transportation engineering (TE) education has been developing both curricula and teaching practices. However, the need for further development and implementation of active leaning techniques remains, especially with regard to specific learning context of the graduate level education. The meaningful implementation of known active learning techniques can make effective use of opportunities arising from information-communication technologies. In particular, this research focuses on development of writing-based in-class activity in a seminar graduate course at San Diego State University. The research builds upon the theoretical framework of learning in engineering education, emphasizing the learnercentered methods. Implementation of in-class activity explains the writing tool deployed and the details of the learning context. Evaluation methodology includes mid- and end-term student survey as well as assessment rubric. Overall, results indicate that this innovation is instrumental in evaluating students' learning in the class, and in helping them with development of motivation and metacognition practices. Concluding implications provide lessons for further implementation and development of active-learning techniques in TE and engineering graduate education in general.

Living Persona Technique applied to HCI Education

Authors: Warin, Bruno; Kolski, Christophe; Toffolon, Claudine

Organisations: Université du Littoral Côte d'Opale, LISIC, 50 rue F. Buisson, Calais, France; Université de Valenciennes, LAMIH-UMR CNRS 8201, Le Mont-Houy – Valenciennes, France; Le Mans Université, LIUM, Institut Claude Chappe – Le Mans, France

This paper aims to present an experience report on a new pedagogical technique which applies to the teaching of interactive systems: the Living Persona technique. First, we remind the well-known technique of Persona that is used in some processes of realization of interactive systems. In this technique, a Persona represents an archetype of the users interacting in the system to be produced. From this Persona technique, we define the Living Persona

one. Within the framework of practical work students have to specify an interactive system, this technique consists in making the teacher play the role of a personnel representative of the contracting authority, who is also potentially a future user of the system to be specified. As a consequence, during his meetings with the students, the teacher has to adopt a behavior in compliance with the state of mind of the users' archetype defined by the Persona. Then we present a pedagogical scenario which integrates this Living Persona technique and we apply it to practical work in which the students must produce an interactive system specification using the Unified Modeling Language (UML). We show through a classroom experience that the practical work set up provides students with work situations close to professional realities. We evaluate the level of interactions between students and teacher and the extent to which this pedagogy influences some students behaviors. Finally, we draw a conclusion on influence of the results of this study on the continuation of our research.

Exploring multicultural e-learning through a blended course across the Mediterranean

Authors: Nascimbeni, Fabio; Burgos, Daniel; Aceto, Stefania; Wimpenny, Katherine; Maya, Isidro; Stefanelli, Cristina; Eldeib, Ayman

Organisations: Universidad Internacional de la Rioja, Spain; Coventry University, UK; Universidad de Sevilla, Spain; UNIMED, Italy; Cairo University, Egypt

This paper presents and reflects upon the training course organized by the OpenMed project, aimed at building capacity in Open Educational Resources (OER) and Open Education approaches across universities from the South Mediterranean, namely in Egypt, Jordan, Lebanon, Morocco and Palestine. The course, which is currently being piloted among 10 universities, represents an example of an intercultural and multilingual learning experi-

ence, both from the way in which it was conceived and developed, to the way it is actually being delivered. In this paper, we reflect on the challenges and benefits of adopting such an open approach towards intercultural learning.

Scratch Day to introduce robotics

Authors: Plaza, Pedro; Sancristobal, Elio; Carro, German; Castro, Manuel; Blazquez, Manuel

Organisations: *PLAZA ROBOTICA, Spain; UNED, Spain*

Scratch Day is a global network of events to celebrate Scratch, the free coding platform and online community for kids. Scratch Day events bring together young people from the Scratch community to share projects, learn from each other, and welcome newcomers. Robotics and computational thinking are ideal tools for developing STEM (Science, Technology, Engineering and Mathematics) pedagogy. Nowadays, robotic education tools arise with the aim of promoting the innovation and the motivation of the students during the learning process. Robots are becoming more common in our daily life; thus, it is important to integrate robots at all levels of our society. This paper presents a workshop which is focused on two main objectives. The first one is to celebrate Scratch Day promoting Scratch locally. On the other hand, this event is aimed to present a robotic educational tool for people as the first step to get into robotics world. This workshop is aimed on those adults who want to discover what possibilities Scratch brings in the introduction to robotics. Throughout this workshop an initiation to Scratch is developed in the context of educational robotics. The obtained outcomes from the educational robotic workshop demonstrate how children and adults without previous experience in programming or robotics can start learning both through experiences in the hands-on session. The result of this work shows that it is important to combine theory and practice with the aim of including

fun tasks intertwined with the challenges that are posed to apply theory in problem solving.

(3F) Virtual and Remote Labs (V&RL) in Engineering Education

Chairs: Schwandt, Andrea

Room: 140 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-18 16:30

Virtual Instruments and Experiments in Engineering Education Lab Setup with Hydraulic Pump

Authors: Nedeljkovic, Milos Srecko; Cantrak, Djordje Svetislav; Jankovic, Novica Zvonko; Ilic, Dejan Bogoljub; Matijevic, Milan Slavko

Organisations: University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia; University of Kragujevac, Faculty of Engineering, Kragujevac, Serbia

Hydraulic pumps are among the most frequently used machines and as such deserve special attention. They are studied in fluid mechanics courses, as well as in more specific engineering subjects. At the University of Belgrade Faculty of Mechanical Engineering Hydraulic Machinery and Energy Systems Department a small demonstrational and educational setup has been designed and manufactured with the aim to demonstrate application of many theoretical issues, such as Bernoulli equation and Euler equation for turbomachinery, as well as to educate on fluid flow phenomena of cavitation and swirling flow. On the other hand, engineering issues, such as pump testing, characteristics of the hydraulic system, pump energy efficiency, calibration of the Venturi meter, etc. are demonstrated. Many components of the installation are transparent and a flow

is always visualized. Calibrated pressure transmitters are built-in and implemented in Lab-VIEW application made for this purpose. Students perform experiments in the laboratory and then generate diagrams and electronic report. In addition to these real experiments, two virtual ones may be also performed - demonstrations of two pumps operating in a serial and parallel mode. Pump hydraulic curves can also be changed by variation of rotational number. This type of regulation may be compared to the valve throttling regulation. Students can measure pump duty points and observe flow rates in each pipe. These issues follow lectures and exercises on the pump topic in engineering education study programmes.

Virtual Laboratory for Automation combinig Inventor 3D models and Simulink control models

Authors: Brito, Julio; Alayón, Silvia; Toledo, Pedro

Organisations: University of La Laguna, Spain

The main goal of this paper is to show how, from a technical point of view, it is possible to implement the control of virtual industrial plants. These plants can be used in virtual laboratories for Engineering Education, specifically, in subjects related to Automation and Control.

Two software tools are needed: one for the graphical implementation of the model of the industrial plant (3D models), and the other for controlling the simulated movements of the elements of this 3D model. In this case, Autodesk Inventor and Simulink (of Matlab) have been the chosen tools.

The design and implementation of 3D models of industrial plants will be explained in the paper. Afterwards, the conversion of these 3D models into block diagrams of Simulink will be detailed. In order to complete the virtual laboratory experience, the connection between a PLC simulator and the proposed simulated plants is necessary. This connection can be carried out in different ways, and this aspect will be also tackled in the article.

Augmented Reality Implementation as Reinforcement Tool for Public Textbooks Education in Ecuador

Authors: Paredes-Velastegui, Daniela; Lluma-Noboa, Amarilis; Olmedo-Vizueta, Diana; Avila-Pesantez, Diego; Hernandez-Ambato, Jorge

Organisations: Polytechnic School of Chimborazo, Ecuador

The present work releases on the methodology followed for the implementation and experimentation of an Augmented Reality (AR) application as a reinforcement tool for teachinglearning activities. The study case was carried out on a sample of 44 participants, who are students of the History subject of the second level of a public high school in Ecuador. The sample was divided into two groups. The AR tool was tested on the Experimental Group (EG), and its performance was compared with that of the Control Group (CG). Results obtained demonstrated that introduction of AR contents can efficiently support both activities and experiences academic, allowing for the enhancement of students grades significantly. In fact, the average grade of the EG was 17.0% higher than that of the CG.

Work in Progress: The Application of a Laboratory Practical Training for Technical Subjects in Engineering Education with E-learning

Authors: Khoroshko, Leonid Leonidovich; Ukhov, Peter Alexandrovich; Khoroshko, Alexey Leonidovich **Organisations:** Moscow Aviation Institute (National Research University), Russian Federation

The paper describes experience of application of the CAD/CAE systems, which are produced by various manufacturers, in the course of development of training courses of a research and development university. Efficiency of application of e-learning in the course of organisation of the practice-oriented training is demonstrated. Examples of the developed training courses for the engineering disciplines are presented. Problems of application of various systems of e-learning and technologies of development of the courses for e-learning are discussed.

SAPIE teaching strategy to develop literacy through immersive virtual worlds

Authors: García Herrera, Darwin G.; Páez Quinde, Cristina; Sánchez Guerrero, Javier; Infante Paredes, Ruth

Organisations: Universidad Tecnica de Ambato, Ecuador, Facultad de Ciencias Humanas y de la Educación

The design of educational activities in immersive virtual environments is one of the emerging prospects in the field of practice and research within e-learning, as well as in the immersive environments with the ability of interaction to provide with a socio-educational dimension of e-learning similarly to face-to-face education, therefore it motivates, stimulates and improves the e-learning educational proposal.

Immersive virtual worlds give the possibility of obtaining a redesign in online traditional educational communication, being its main contribution return the characteristics of a classical face-to-face education. However, this type of teaching has some negative aspects, such as the cost of optimal technical equipment required to access to these tools, the suitability of the interface with the user, or at the same time the problem arising from the place of learning. These aspects are important because they will allow the correct immersion of the user in the educational process, such as disconnection, lack of motivation, loss of fidelity to the model or frustration,

(3G) Knowledge and Competencies in Engineering Education

Chairs: Thurner, Veronika

Room: 340 people plenary room with speaker and presidency table located in the basement at the right of the reception

Date and time: 2018-04-18 16:30

Evaluation of a Diagnostic Test for Competences that are Relevant in Computer Science - Detailed Focus on Methodical Competences

Authors: Hammer, Sabine; Zehetmeier, Daniela; Böttcher, Axel; Thurner, Veronika

Organisations: University of Applied Science Munich, Germany

Especially at the beginning of university studies, students form in many aspects a heterogeneous group. Compared with other disciplines, there is a significant dropout in computer science. We ascribe this to the fact that firstsemester students often have significant deficits in cognitive competences - such as systematically and logical thinking - which are crucial for studying computer science successfully. To capture students' learning capabilities, we developed a diagnostic test containing tasks to evaluate the incoming students' initial level of relevant important cognitive competences. In this paper, we evaluate the quality of the diagnostic test from a statistical point of view. Particular emphasis will be placed on the analysis of the methodical competence. We assume that this component of students' cognitive competences is of particular importance as it is relevant not only for a successful start in the study

phase but it is also essential for acquiring new skills and competences in computer science.

Expanding 1st year problem-solving skills through unit conversions and estimations

Authors: Tadie, Margreth; Pott, Robert; Wolff, Karin; Goosen, Neill; Van Wyk, Petrie

Organisations: Stellenbosch University, South Africa

Rapidly evolving technologies have placed a challenge on engineers to become more innovative in their thinking and driven an ever increasing need for 'complex problem' solving abilities. The burden is placed on higher education to produce higher quality engineers than before, and to ensure that all aspects of the curriculum are adequately grasped by students. This is includes so called foundational knowledge/ base concepts, such as units conversions. Enabling students to understand what units represent, the relationship between the different systems, and the procedural conversion processes are essential to adequately equipping engineering students to engage with higher level, complex problem solving. This entails making explicit the differences between principles, procedures and possibilities. A useful analytical framework to aid educators has emerged in the shape of Legitimation Code Theory (LCT), which is proving invaluable in Science, Technology, Engineering and Mathematics (STEM) educational research. One particular tool is the epistemic plane which differentiates between a phenomenon and its approaches. In this work a unit conversions and estimations online test is demonstrated as a tool to enable learning, and LCT as an analytical framework to inform teaching practice for the achievement of engineering competence. The tool was developed and used as an assessment based learning opportunity for engineering students in order to instill the basic skill of unit conversions. The tool also provided a further learning opportunity for students to engage with higher level

(situational) thinking. The application of the epistemic plane to the entire exercise revealed information regarding lecturer's and students' perceptions, as well as potential approaches to increasing students' abilities to engage with more complex problem-solving techniques from base concepts at an earlier stage in their engineering education.

Introducing Storytelling to Educational Robotic Activities

Authors: Angel-Fernandez, Julian Mauricio; Vincze, Markus

Organisations: Technische Universität Wien, Austria

Creativity is a skill that has been recognized as one of the 21^{st} century skills. Likewise robotics has been recognized as technology with several features to enthrall children and be used to teach a variety of topics (e.g. Mathematics and programming). This paper presents a study done to verify the impact of introducing a storytelling session in an activity with children from 6 to 18 years old in Austria. A total of 196 participants participated in the workshops, held in the campus of the university. Quantitative and qualitative data were collected and analyzed. The results showed that the most difficult task for old participants was the collaboration between groups created. Participants also did not mention the use of creativity during the design and implementation of the story. Instead participants referred to the work done with robots and technology. Moreover, participants think that working with robots is interesting and fun.

A Competency-based Approach toward Curricular Guidelines for Information Technology Education

Authors: Sabin, Mihaela; Alrumaih, Hala; Impagliazzo, John

Organisations: University of New Hampshire, United States of America; Al Imam Mohammad Ibn Saud Islamic University, Riyadh, Saudi Arabia; Hofstra University, United States of America

The Association for Computing Machinery and the IEEE Computer Society have launched a new report titled, Curriculum Guidelines for Baccalaureate Degree Programs in Information Technology (IT2017). This paper discusses significant aspects of the IT2017 report and focuses on competency-driven learning rather than delivery of knowledge in information technology (IT) programs. It also highlights an IT curricular framework that meets the growing demands of a changing technological world in the next decade. Specifically, the paper outlines ways by which baccalaureate IT programs might implement the IT curricular framework and prepare students with knowledge, skills, and dispositions to equip graduates with competencies that matter in the workplace. The paper suggests that a focus on competencies allows academic departments to forge collaborations with employers and engage students in professional practice experiences. It also shows how professionals and educators might use the report in reviewing, updating, and creating baccalaureate IT degree programs worldwide.

On the Intrinsic Complexity of Logical Transformation Problems

Authors: Shoufan, Abdulhadi; Alnaqbi, Abdulla

Organisations: Khalifa University, United Arab Emirates

The design of combinatorial and sequential circuits relies on multiple logical transformation steps.

This paper investigates the intrinsic complexity of eight logical transformation problems: (1)from human-language statement into formal function, (2)-from formal function into truth table, (3)-from truth table into formal function, (4)-from formal function into k-map, (5)- from truth table into k-map, (6)-from k-map into minimized formal function, (7)-from formal function into minimized formal function using Boolean algebra, and (8)-from formal function into digital circuit. 27 potential complexity variables were first identified and specified and a total of 303 test items/problems were generated and solved by up to 43 students each with time recording. The level of intrinsic complexity was defined based on average solving time and error ratio. Regression models were generated to establish a predictive relationship between the intrinsic complexity level and the complexity variables for each transformation problem. Apart from Transformation 7, the regression models showed adjusted R-square values between 81% and 94%. These models can be used to predict the solving time of new problems towards the development of reliable tests. Coherence and Cohesion Issues in Argumentation Documents Written by Engineering Students

Authors: Candelo Becerra, John Edwin; Gabriela Calle, María; De Castro, Adela; Soto Ortíz, Jose Daniel; Torres, Luis; Schettini, Norelli; García, Lucy

Organisations: Universidad Nacional de Colombia, Medellín; Universidad del Norte, Barranquilla, Colombia

This paper presents an evaluation of the coherence and cohesion of argumentative texts written by engineering students. The work is based on a five-paragraph essay model, where students must argument on a predefined topic assigned by the professor. The team detected problems in most students in the aspects of coherence and cohesion when challenged to produce argumentative texts. These problems affect the way future engineers communicate their ideas, affecting their performance in the workplace. These results are valuable to help students improve their communication skills.

(4A) Collaborative work and Technologies for Engineering Education

Chairs: Ashmawy, Alaa

Room: 50 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-20 08:30

Motivation related predictors of engagement in mobile-assisted Inquiry-Based Science Learning

Authors: Nikou, Stavros; Economides, Anastasios

Organisations: University of Macedonia, Greece

One of the major priorities of education systems nowadays is to promote Inquiry-Based Science Learning (IBSL). Research has shown that mobile learning can support and enhance inquiry-based science learning promoting learning achievement and motivation. However, engagement, as a consequence of motivation, in the context of mobile-assisted inquiry-based science learning, has not been adequately investigated. The current study implements a collaborative mobile-assisted inquiry-based science learning intervention in the context of secondary school science. The study is aiming at explaining and predicting student engagement in terms of the motivational concepts of autonomy, competence and relatedness from the Self-Determination Theory (SDT) of motivation. Data collected for 80 secondary school students and analyzed with structural equation modeling. The proposed model explains about 63% of the variance in students' engagement in mobile-assisted inquiry-based science learning. Perceived autonomy was found to be the strongest predictor of engagement, followed by perceived relatedness. Based on the research findings, implications for practice and suggestions for future studies are also discussed.

Engineering Education Lab Setup Ready for Remote Operation - Pump System Hydraulic Performance

Authors: Nedeljkovic, Milos {Srecko}; Jankovic, Novica {Zvonko}; Cantrak, Djordje {Svetislav}; Ilic, Dejan {Bogoljub}; Matijevic, Milan {Slavko}

Organisations: University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia; University of Kragujevac, Faculty of Engineering, Kragujevac, Serbia

Educational setup for demonstration of a pump operation and its full performance curves and flow meter calibration in students' lab measurements is of great significance for practical work and research. Practical work, with concept "do it yourself", awakens greater students 'enthusiasm for the studied topic. Upgraded demonstration-educational hydraulic pump installation is designed and built at the University of Belgrade Faculty of Mechanical Engineering Hydraulic Machinery and Energy Systems Department. The upgrade of this set has been done towards more complex hydraulic system, data aquisition and computer control of the processes, as well as to the internet connection and availability for remote operation.

The intention is to create a complex experiment which could be conducted via internet, so students can measure and calculate necessary values, generate electronic report on distance and discuss obtained results with the lecturer. This work is part of the well-established GoLab project (EPFL).

Development of "KamiRepo" System with Automatic Student Identification to Handle Handwritten Assignments on LMS

Authors: Seiya, Shunya; Ito, Ryuya; Okamoto, Kosuke; Tanikawa, Ukyo; Ohira, Shigeki; Deguchi, Daisuke; Toda, Tomoki

Organisations: Graduate School of Infor-

matics, Nagoya University, Japan; Graduate School of Information Science, Nagoya University, Japan; Information Technology Center, Nagoya University, Japan; Information Strategy Office, Nagoya University, Japan

A Learning Management System (LMS) has become a fundamental tool for higher education, and a framework to leverage digital education data in the LMS has attracted attention. On the other hand, there is strong demand to deal with various education data provided not only from electronic media but also non-electronic media, such as a handwritten assignment. To solve this problem, this paper describes the development of "KamiRepo" system to make it possible to automatically upload handwritten assignments to the LMS. In this system, optical character recognition (OCR) is performed to identify scanned handwritten assignments of individual students and read their scores. Then, their scanned files automatically separated from the entire file of the scanned handwritten assignments are returned to the individual students through LMS together with their corresponding scores. Compared with a conventional system using the dedicated multifunction printer, our developed system is capable of 1) using general-purpose scanners, 2) using a user interface on Web browser, and 3) achieving accurate student identification. We have launched this system in our university in April 2017 and have evaluated its effectiveness. The experimental results using real data collected for 6 months showed that our system achieved 99.7% of success rate in the automatic upload process.

Location Based Games as the bridge between Capstone Students, Junior Students and the public

Authors: Greeff, Jacob Jacobus; Heymann, Reolyn; Nel, Andre Leon; Carroll, Johnson

Organisations: North-West University, South Africa; University of Johannesburg, South Africa This paper describes the design and implementation of a location based Alternate Reality Game (ARG) as well as the results obtained during it's first successful implementation in 2016. In this ARG, players consist of Capstone Students, 3rd Year Students, Study Leaders and members of the public. During a one day event held every year, Capstone project students get to demonstrate the work they did during the academic year to obtain feedback from a much wider audience; including presentations done across various locations on the university campus. A QR code based system was used for physical location marking, and the game was deployed to a web based platform. A total of 65 students, 17 Study Leaders and 51 Visitors took part across 6 campus locations with 242 individual interactions recorded. Details are added about the design methodology and system developed.

Electrical Engineering course using PBL – the lighting of historical buildings

Authors: Travassos Valdez, Manuel; Machado Ferreira, Carlos; Maciel Barbosa, Fernando

Organisations: Instituto Superior de Engenharia de Coimbra, Portugal; Faculdade de Engenharia da Universidade do Porto, Porto

In engineering skills are acquired, improved and maintained through specific training to ensure the best quality in the technical aspects. However, cost constraints, limited instructional time, and the complexity of technical procedures have placed constraints, making systematic training in real situations unfeasible.

Much of the electricity produced globally is consumed in lighting. Therefore, the need arises to adopt energy efficient lighting systems. The use of LED technology, a low-emission lighting system, is an effective option with great reduction of energy consumption.

In order to deal with the complexity of a Light-

ing Design project, it is necessary to use learning techniques and the right software to help students deal with the problem.

The approach to a project using PBL invites students to find a solution for a given problem, involving them in a process that is both motivating and produces good results. Instead of expecting a solution to a problem, students are learning by doing all the necessary studies and calculations to reach an ideal conclusion.

Using a DIAlux software, a lighting system was simulated for the exterior of the Law Court in Coimbra using light sources of the LED type. The Law Court is housed in the University College of St. Thomas Aquinas belonging to the Order of St. Dominic (1549). This proposal was compared with the existing lighting system in order to supply quality lighting with less energy consumption, thus making it more energy efficient.

This paper presents the study carried out in the Electric Power Systems Project (EPSP) of the Electrical Engineering course using PBL under a protocol between the Law Court and the Instituto Superior de Engenharia de Coimbra (ISEC / IPC).

(4B) Systems and Technologies for Learning

Chairs: Langmann, Reinhard

Room: 340 people plenary room with speaker and presidency table located in the basement at the right of the reception

Date and time: 2018-04-20 08:30

Development of a Signal-Toolkit to Increase the Availability of Measurement Equipment at Courses Dedicated to Technical Sciences

Authors: Beneder, Roman; Lechner, Markus; Schmitt, Patrick

Organisations: UAS Technikum Wien, Austria

Typically universities with a focus on technical sciences provide courses where students have to measure analog/digital signals and analyze different types of embedded communication interfaces. Specifically, the University of Applied Sciences Technikum Wien equips all students (full-time, part-time, and distance learning), based on OPES (One Platform for Every Student), with embedded learning platforms to train their technical skills and expertise extensively.

This availability of real embedded learning platforms implies that the appropriate measurement equipment has to be available as well. Of course, students have access to measurement equipment at the university, but to be able to complete the exercises and assignments at home, it is mandatory to have access to measurement equipment outside the university. Hence, students with special needs and distance learning students, neither have time nor have easy access to complete their exercises and assignments with professional measurement equipment. To address this need of access outside the university, a suitable signal toolkit is necessary. To offer this measurement equipment for every student, it has to be affordable for the university. Furthermore, it should provide convenient features and functions, should be executable on various operating systems, and easy to maintain.

This paper describes the development of a versatile, low-cost, open-source signal toolkit which has the potential to increase the availability of measurement equipment and closes the lack of access. Moreover, this paper gives an overview of the signal toolkit architecture, the hardware components, and the graphical user interface.

A Documentation Approach for Higher Education

Authors: Lehmann, Alexander

Organisations: Coburg University of Applied Sciences and Arts, Germany

Systematic documentation is an important aspect in order to preserve information that would otherwise be lost over time. Documentation is needed in different disciplines, but is not so common in education and especially in software engineering's education. Education is a very diverse field, situations which are meaningful to document must be detected first, which implies a need for a flexible documentation environment. One main problem is, we have different situations and we need a concept to document each situation in a flexible way. Usually documentation patterns (documentation templates) are used to document a specific situation or a group of specific situations, so the usage of one given pattern for many different situations could be problematic. That is why there is a need for another concept to document such situations. The paper presents an documentation approach which reverses the typical concept of documentation patterns. Usually patterns are given first for specific problems. This paper presents an flexible approach which let documentarists create their own pattern for their specific situations which may solve the named problem.

Teaching Keylogging and Network Eavesdropping Attacks: Student Threat and School Liability Concerns

Authors: Trabelsi, Zouheir; Saleous, Heba

Organisations: UAE University, United Arab Emirates; College of IT, UAEU

Nowadays, keylogging and network eavesdropping are very common network attacks and important topics in information security education. This paper discusses what academics need to know about keylogging and network eavesdropping attacks. The paper does so in the hope that it will encourage the teaching of these security topics when offering modules on information security. Then, the paper discusses the threat of teaching keylogging and network eavesdropping attacks and proposes steps to minimize the risk of inappropriate student behavior and reduce institutional liability.

Methodological proposal for automatic evaluation in collaborative learning

Authors: Moreno-Ruiz, Lorenzo; Castellanos-Nieves, Dagoberto; Popescu-Braileanub, Beatrice; González-González, Carina

Organisations: Universidad de La Laguna, Spain; Instituto Astrofísico de Canarias, Spain

In this paper, a methodological approach based on constructivism and collaborative work is presented. In particular, a semi-automatic and automatic validation of this methodology is described. A rubric has been defined with 4 main indicators such as student role in the group, student level of participation and interaction, results and quality of messages exchanged. Also, several technologies have been used for the automatic evaluation like natural language processing, social networks and fuzzy reasoning.

A "Laboratory" as an Approach to Foster Writing Skills at Software Engineering Studies

Authors: Kampmann, Matthias; Mottok, Jürgen

Organisations: Ostbayerische Technische Hochschule (OTH) Regensburg, Germany

This paper presents a new course format to increase the reading/writing skills of students. It is named c*lab (Writing Laboratory for C-Language Learners) and is a means to foster the quality of student's writing at the faculty of Electric and Information Science at the OTH Regensburg. It is based on the concept of "Writing Across the Curriculum/Writing in the Discipline". Organized parallel to a lecture of learning to program the language C, and addressing students of the first semester, the course is a complete voluntary offer in addition to general courses and lectures of the faculty. Students not only practice writing. They also learn the basic use of LaTeX to write a first paper. Agile education methods are used to enrich the course based on the experiences of the contructivist learning theory.

Semantics and service technologies for the automatic generation of online MCQ tests

Authors: Álvarez, Pedro; Baldassarri, Sandra

Organisations: University of Zaragoza, Spain

New e-learning methodologies require assessment procedures that automatically measure the students' achievements during the teaching and learning process. Multiple-Choice Questions (MCQ) tests have been widely used as an assessment tool by these methodologies. Basically, a MCQ consists of a question text and a few choices, from which one is the correct answer and the rest are incorrect alternatives (called distractors).

Recent efforts have focused on the automatic generation of well-constructed MCQs. Most of the MCQ automatic creation systems are based on the use of the semantics. Their goal is to generate distractors that are somehow semantically similar to the correct answer and, subsequently, using these distractors to create the assessment test. Nevertheless, these systems present a set of disadvantages that restrict their applicability: they require as input a predefined knowledge base (a corpus or an ontology that represents the contents of a course), their strategies for generating distractors are only based in the notion of semantic similarity between the knowledge base's concepts and the correct answer, and, finally they delegate in the teacher the final composition of the tests from the generated distractors (exceptionally, some of these systems create simple tests from templates).

In this paper, we propose a service-oriented system to generate online MCQs automatically. The system has been implemented using Web, semantics and cloud technologies. Unlike other existing systems, our solution interacts with a set of online semantic services (WordNet, Wordnik and Wikipedia) in order to create a new specialized knowledge base for the generation of each MCQ. Then, the distractors are automatically generated combining a set of heuristics that analyze the semantic similarity, the relevance and quality of the distractor in the question's context, and the difficulty level of tests. Finally, the system automatically creates a test from the questions and the generated distractors using Google Forms.

(4C) Engineering diversity and inclusiveness

Chairs: Dalipi, Fisnik

Room: 60 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-20 08:30

Technical aspects of preparing museum expositions for the visually impaired by using 3D technologies

Authors: Montusiewicz, Jerzy; Miłosz, Marek; Kęsik, Jacek

Organisations: Lublin University of Technology, Poland

People with visual impairment, deprived of their most important sense, are excluded from experiencing the cultural heritage presented by museums in a traditional manner. Proper experience of an exposition for these people could only be available by approaching the exhibits literally in a hands-on fashion. In most cases, however, such direct contact with them is not possible due to the risk of damage. The alternative is to prepare "touchable" models of exhibits. An exposition containing such exhibits would be a way to provide cognitive benefits for visually impaired people. 3D technologies can greatly facilitate the creation of such models and expositions that have so far been produced manually.

From the cultural institution point of view, the preparation of copies of exhibits adapted to the needs of the visually impaired is divided into the following stages: selecting objects for the exposition, preparing the documentation, object description and model requirements, making a "touchable" copy of the object by one of the available methods and preparing objects for presentation and constructing the exposition.

Up to now, the most laborious and costly stage was that of preparing copies of museum exhibits. The study describes in detail the selection of 3D scanning technologies, the process parameters, the tools applied or issues to do with postprocessing the obtained point cloud being a rough reflection of the exhibit surface. Moreover, choosing the 3D printing technology is presented with a view of the safety of the person interacting with the copy, the produced object's durability and the cost of its production.

The article also presents applying the above 3D technologies in an attempt to build expositions for the visually impaired, realised in collaboration with the Zamoyski Museum in Kozłówka, based on a set of sculptures from the mid 20th century.

Predicting Engineering Students' Needs and Optimal Group Size using K-means Clustering on Socio-Educational Features

Authors: Mohammad, Walid; Afrose, Sharmin; Sharmin, Sadia

Organisations: Bangladesh University of Engineering and Technology, Dhaka, Bangladesh.

In engineering education, students' perception

of their learning environment plays a vital role in their success. That is why it is important to understand the perceptions and opinions of the students' regarding different matters of the university in order to provide a good engineering education. Such perceptions and opinions, which are critical towards the success of an engineering student, are very often influenced by the socio-educational background of the students. May et al. showed that background factors such as pre-college preparation are correlated with the success of an engineering student. In the developing countries like Bangladesh, which has a comparatively higher income inequality, the students attending the universities have more socio-educational dissimilarities in their backgrounds. Many students may attend a preuniversity institute having a different medium of instruction such as Bangla language or English language. Some may come from village whereas some may have an urban background. Again, some stay with their family whereas some may have to stay all alone in a hostel. These differences in socio-educational features form the basis of their opinion about different aspects of their education. In these work, we surveyed the engineering students of BRAC University of Bangladesh (N=237) and clustered the students using K-means clustering algorithm based on their socio-educational features such as gender, credit earned, preuniversity education medium, previous residence, current residence etc. Then we used the clusters to predict what kind of perceptions a student of certain socio-educational features might have about different engineering educational aspects. We also determined an optimal number of clusters for the surveyed data set. The resultant clustering can, thus, work as a good predictor to predict notions and views of engineering students having different socioeducational features from the perspectives of third world countries such as Bangladesh.

The Influence of German Schools on Heterogeneity of Knowledge in Informatics in the Study

Authors: Klopp, Marco; Haak, Valentin; Abke, Jörg

Organisations: University of applied sciences Aschaffenburg, Germany

This Paper deals with heterogeneity and the influence of the school system on the different students' knowledge in informatics in the study. Goal of the paper is to analyse the German school system and the curricula of 16 federal states.

First, this paper describes heterogeneity and its relevance in education. The focus is on the knowledge-base of students. The next step is to take a closer look at the subject of computer science in the German school system. In this context, the recommendations of the "Gesellschaft für Informatik" plays an important role.

In order to investigate the influence that school education has on heterogeneity in students' knowledge levels, the 16 curricula of the federal states are presented in a clear way. These are compared with examples with the information of four students generated by a survey. After the results, the procedure and the analysis will be reflected. Finally, heterogeneity is considered from a pedagogical point of view.

REVIEW OF RETENTION PRO-GRAMMES FOR FEMALE INDUS-TRIAL ENGINEERING STUDENTS

Authors: Mouchou Tchamdjeu, Rosine

Organisations: University of Johannesburg, South Africa

Due to constrained resources South African universities are aware and focused on trying to improve retention. This is also true at the University of Johannesburg where by industrial engineering has a higher intake of female students than some of the other engineering fields. Retention of female engineering students is therefore an important aspect to investigate. However at the University of Johannesburg in general female students are retained better than male students. This article will look into whether or not female engineering students are retained better than male students. The study will add to the knowledge on the effectiveness of retention of female industrial engineers in South Africa institution.

Improving Access to Online Lecture Videos

Authors: Bauer, Matthias; Malchow, Martin; Meinel, Christoph

Organisations: Hasso-Plattner-Institut, Germany

In university teaching today, it is common practice to record regular lectures and special events such as conferences and speeches. With these recordings, a large fundus of video teaching material can be created quickly and easily. Typically, lectures are held for about one and a half hours and usually take place once or twice a week depending on the credit hours. Depending on the number of lectures and other events recorded, the number of recordings available is increasing rapidly, which means that an appropriate form of provision is essential for the students. This is usually done in the form of lecture video platforms.

In this work, we have investigated how the lecture videos and the contained knowledge can be improved and accessed more easily by more students. We came up with a multistep process we have applied at our own lecture video web portal that can be applied to other solutions as well.

(4D) $\mathbf{E} \cdot \mathbf{Assessment}$ and new Assessment Theories and Methodologies

Chairs: García-Holgado, Alicia

Room: 50 people, theater style, 3 people presidency table, video projector and computer, area mezzanine up of the conference center

Date and time: 2018-04-20 08:30

Agile methodologies applied in the teaching-learning process in engineering: A case of study.

Authors: Soto Guerrero, Fernanda Maricela; Sucunuta España, Manuel Eduardo; Rodríguez Morales, Germania del Rocío; Cueva Carrión, Samanta Patricia; Jaramillo Hurtado, Danilo Rubén; Abad Espinoza, Marco Patricio

Organisations: Universidad Técnica Particular de Loja, Ecuador

To espouse the principles, values and agile practices in the academic scope, it is proposed to use the Scrum methodology as a reference model for teamwork, where the results are obtained incrementally, established short periods of works referenced by a pattern. The prioritized requirements list are given by applicant (teacher), who at the beginning of the academic period (6 months) together with the team (students and teachers) decide the possible points of the list to make in that lapse of time. The same team determines the tasks necessary your assignment. once the academic period is over the results are presented and who requested them will validate the compliance with the requirements. Then, the team reflects together about the work done highlighting positive and negative aspects, improvement proposal and if necessary make a new interaction.

This is repeated until the result meets the expectations of the applicant, who is in constant communication with the team being able to introduce changes in both the requirements and the priority of these.

Introducing Competitiveness and Industry Involvement as Learning Tools

Authors: Llopis Pascual, Fernando; Guerrero, Fernando

Organisations: University of Alicante, Spain; Solid Q, Spain

Continuous changes in the real world of technology involve adapting the learning content and models to the new requirements of the industry. To keep up with these changes, the industry must be deeply involved in the training experience of new students. On the other hand, increasing competitiveness in the learning experience improves students motivation and inspire them to reach higher levels of excellence.. In this paper, we describe a learning environment that is being used to engage and empower students following an undergraduate software engineering course. The methodology is a combination of three main ideas: competition between student teams, Project Based Learning (PBL) with competition between teams and using industry experts as product owners, o project managers, of students teams. The goal is that four teams of students will design and develop s software project based on the same Requirements. Each team is composed by over ten students and is led by an industry expert, as project manager or product owner.

Learning analytics for location-based serious games

Authors: Pérez Colado, Victor Manuel; Rotaru, Dan Cristian; Martínez-Ortiz, Iván; Freire Moran, Manuel; Fernández Manjon, Baltasar

Organisations: Universidad Complutense de Madrid, Spain

Pervasive gaming has experimented a huge Commercial growth with location-based games successes such as Pokémon GO or Ingress. The serious game industry has an opportunity to take advantage of these location-based mechanics to better connect games with the real world, creating highly immersive learning environments. Games such as historical tours, story-based exploration, laboratories, or flora explorations can greatly benefit from locationbased mechanics. Locationbased games usually include an augmented map to provide game context, which includes, as overlays, both traditional gamedependent elements such as avatars, and location-based elements such as areas or points of interest. For players, interacting with these elements may involve reaching a certain location and looking in a given direction; or entering or exiting specific areas.

To allow standards-based learning analytics for location-based serious games, we have added support for player movement and locationbased interactions to the xAPI serious game profile. We have validated this approach through an experiment that guided players through different sports-related facilities within a large outdoor area, and have made it available as part of the analytics infrastructure used in two EU H2020 serious game projects.

Active Project Based Learning Pedagogies: Learning hardware, software design and wireless sensor instrumentation

Authors: Banakhr, Fahd Ahmed; Iqbal, Muhammad Javed; Shaukat, Nabil

Organisations: Yanbu Research Center, Royal Commission Yanbu Colleges and Institutes, Saudi Arabia

Abstract— Project based active learning is student centered approach of teaching in which project based on certain problems is given to students. Teacher breakdowns this project into some driving questions and gets involve students into individual or group based activities to solve these questions. This paper discusses four stage processes to implement Project Based Learning methodology to teach electronics hardware, software and wireless sensor instrumentation to the students. The role of teacher to divide project into different tasks and driving questions for successful implementation of the project is also discussed in this paper. The observations based on students' performance showed that they takes more interest in their work and enjoy more in individual or group based learning to solve certain problems. Later this project won 1st prize in Student Project Competition 2013 organized by National Instruments Arabia.

(4E) Attracting and retaining practices in Engineering Education

Chairs: Seralidou, Eleni

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-20 08:30

Scaffolding Students on Connecting STEM and Interaction Design

Authors: Matias, Igor; Pombo, Nuno; Lamas, David; Garcia, Nuno; Tomberg, Vladimir

Organisations: Instituto de Telecomunicações, Lisboa, Portugal; Universidade da Beira Interior, Covilhã, Portugal; Instituto de Telecomunicações, Lisboa, Portugal; Universidade da Beira Interior, Covilhã, Portugal; Universidade Lusófona de Humanidades e Tecnologias, Lisboa, Portugal; Tallinn University, Tallinn, Estonia

Fusion multidisciplinary subjects in order to present a unique and complementary perspective may enhance and extend the knowledge acquisition, and consequently, the student experience. In this paper we report a case study on methodology, which interlinks various subjects creating and engaging learning process by combining Science, Technology, Engineering and Mathematics (STEM) and Design. In line with this, an Experimental Interaction Design summer course was designed and implemented based on a multi-cultural, defiant and creative environment in order to provide an effective learning on solving the real-world challenges. Twelve students were involved in this initiative, which resulted in the development of several projects such as a pets' tracking and behavior analysis, a smart home for elderlies, and a medication reminder device, in which design, prototyping, usability evaluation and programming concepts were combined. In this report, we focus on the study design with the aim to provide scaffolding for multidisciplinary teams of students in design-based projects that require STEM competences.

Discovering children's competences in coding through the analysis of Scratch projects

Authors: Papavlasopouloou, Sofia; Giannakos, Michail; Jaccheri, Letizia

Organisations: Norwegian University of Science and Technology, Norway

Computational thinking and coding has received considerable attention over the past several years. Considerable efforts worldwide suggest the need for more empirical studies providing evidence-based practices to introduce and engage children with coding activities. The main goal of this study is to examine which programming concepts students use when they want to develop a game, and what is the interrelation among these concepts. To achieve our goal, a field study was designed and data were collected from coding activities. In detail, during a two-week period, one-day workshops were organized almost every day on which 44 children participating in, with ages between 8-17. The workshops follow a constructionist approach and comprise of two parts. First the children interact with robots, and then develop a game using Scratch. The findings provide a deeper understanding on how children code by showing the use of specific programming concepts to develop their projects and their correlations. Hence, we improve our knowledge about children's competences in coding.

System Dynamics Modelling to Attract Students to STEM

Authors: Alyammahi, Sohailah; Zaki, Rachad; Barada, Hassan; Al-Hammadi, Yousof

Organisations: Khalifa University, United Arab Emirates

The paper demonstrates how a K-12 educational system can be modeled using system dynamics in order to recommend policies changes with the objective to increase the number of students interested in STEM subjects in high schools and beyond. Although we use data and variables from the United Arab Emirates (UAE) education system, the system dynamics models apply to many education system in the world with minimum modifications.

Validity evidence for STEM problem solving MCQs

Authors: Buckle, Jane V; Shannon, Mark; Robson, David; Devine, Amy; Housden, Mike; Cheung, Kevin; McElwee, Sarah

Organisations: University of Cambridge, United Kingdom

This paper presents the development of an admissions assessment supporting applications to engineering undergraduate courses of study. The role of an assessment and construct validity considerations for test development are discussed, drawing on a review of the skills needed for engineering study at undergraduate level.

First-Year Computer Science Students Perception of Lecturing in Relation to the Type of High-School Education

Authors: Standl, Bernhard; Guenther, Elisabeth Anna; Wetzinger, Elisabeth; Futschek,

Gerald

Organisations: Vienna University of Technology, Austria; Cranfield School of Management, United Kingdom

During the first year of computer science studies, students frequently experience difficulties, which can have multiple reasons. We have observed a tendency that students with computer science education at high-school seemed to be more confident and successful in their studies than students with a regular high-school education. As we experienced differences in particular during lectures, we were interested in both groups' perception during lectures that nudges students' way towards success or failure in order to identify possible pitfalls for students without computer science pre-education. To this end, we set up a mixed-methods research consisting of a pre- and post-term questionnaire as well as interviews and group discussions. We asked students about their experiences with teaching and during the first-year at our university. First results indicate that there are no significant differences in both student groups regarding the perception of teaching and teaching methods. However, students with no computer science high-school education are more likely to struggle with introductory coding classes, in particular at the beginning of their first term.

The Lack of Preparation of Students that Enter Engineering Courses in Brazil

Authors: Madeira, Viviane; Mello, Andréa Justino Ribeiro; Mello, José André Villas Boas; Afonso, Herlander Costa Alegre da Gama; Souza, Ana Luiza Lima de; Koleilat, Musbah; Peixoto, Aruquia

Organisations: CEFET/RJ, Brazil

Engineering course starts with the basic disciplines: mathematics, physics, programming and chemistry. Many students have difficulties in Engineering due these basics disciplines. From all these disciplines, mathematics is the one that requires most years of preparation before enter the university, and Calculus I is usually the biggest barrier to these students. In Brazil the most important high education system are the public universities, with the federal universities and technological institutes as the main system that covers the entire country with at least one unity in each of the twentysix states. They are public institutions that provide undergraduate and graduate courses, and are some of more prestigious institutions in the country. In junior and high school the system that provides education are the state and municipality, they offer public schools, but the families that can afford a private school pay these schools to their sons have a better education. To enter the university, the students compete in a national test, where the content of the junior and high school is tested, and the students from private schools have better results in this test. The students with higher results enter the federal institutions of high education. When the students enter an Engineering course, the number of students that fail in Calculus is high, reflecting the lack of preparation during the junior and high school years. This works try to identify the knowledge of students in the first semester in Calculus, and how much they improve their knowledge during this semester, to identify the impact of the university in these students.

(4F) Curricula Developments and Project base Learning

Chairs: Sabin, Mihaela

Room: 140 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-20 08:30

Reflective team meetings: a learning experience for first-year engineering students in joint projects

Authors: Havenga, Marietjie

Organisations: North-West University, South Africa

The aim of this research was to report on reflective team meetings as a learning experience for first-year engineering students in joint projects. To some extent, working in joint projects is new to first-year students since they had been exposed mainly to the direct teaching method in a well-defined school environment previously, which required of them to remember instead of to construct knowledge and manage their learning. Moreover, in school settings, students are not used to solve problems collaboratively. In engineering, addressing problem-based projects in teams requires frequent formal meetings to enable students to make decisions, coordinate tasks and reflect on their actions. Reflection as a rigorous intellectual and emotional action takes time to develop and is a means of guiding and supporting students' collaboration and professional practice. Reflective practices are of particular importance when addressing ill-structured problems in engineering, which have multiple, sometimes conflicting goals, are solved in different ways, and sometimes require extensive collaboration where knowledge is distributed among team members. A qualitative research methodology was employed. The population consisted of 380 first-year engineering students who enrolled in 2016 for a compulsory introductory course, which covered team collaboration and meeting procedures, assessment, safety and security, project management and practical workshop activities. Data collection comprised students' reflective project sheets and written narratives regarding their experiences. Data were manually analyzed, coded and organized into themes. Results indicated that, although students initially experienced challenges, such as time constrains and management of teams, formal team meetings provided the likelihood of developing reflective skills as a learning experience in joint projects. Implications for engineering education are also highlighted.

A Proposal for an Inductive Approach to Teaching and Learning About Energy Loss

Authors: Simpson, Zach; Meyer, Johan

Organisations: University of Johannesburg, South Africa

Energy is an important topic in science and engineering. Yet, clear definitions of this concept are difficult to come by and, as a result, students often develop a limited understanding of energy and energy-related concepts. This is exacerbated by traditional, deductive means of teaching. In this paper, the authors propose an inductive approach to the teaching and learning of energy-related concepts, including conservation of energy. This approach was adapted from an article in the literature which addressed flight energy management training for pilots. It is argued that the inductive approach proposed fostered a deeper understanding of energy flows within a system and that it placed the learners in good stead for their subsequent design of an ultra-energy efficient hydrogen-powered vehicle. Further attention needs to be given to how such an inductive learning approach can be incorporated into formal curricula at both school and university levels, with a diverse range of students.

The employer perspective on employability

Authors: Lundberg, Gunhild Marie; Gaustad, André; Krogstie, Birgit Rognebakke

Organisations: Norwegian University of Science and Technology, Norway

Employability is a term used for describing the skills, knowledge and personal qualities a graduate should possess to get a job. In this paper we suggest what these skills and qualities are for IT undergraduates specializing in network administration. We have interviewed 10 recruitment managers from 9 different companies who have employed candidates from an IT network administration study program. They suggest that personal qualities are the most important aspect they look for in the graduates. We found that several of the recruiters want the graduates to have an interest in technology also outside of the curricular activities or work setting. This type of interest is taken as a sign that the graduate/job seeker is able to employ their knowledge in practice and engage in continuous self-development and lifelong learning, validating their employability. We discuss how the university can cater for curricular as well as extra-curricular activities, thus leveraging as well as developing the interest in the field valued by employers.

Development of 'Soft Skills' Through Extra-Curricular Project Work: The Case of the Jozi Digital Ambassadors Project in Johannesburg, South Africa

Authors: Simpson, Zach; Benecke, Dalien Rene; Janse van Rensburg, Nickey

Organisations: University of Johannesburg, South Africa

The primary focus of engineering curricula is technical competence. However, literature suggests that a common shortcoming of engineering graduates pertains to so-called 'softer' skills such as leadership, team work, time management and communication. Although not core to Engineering activity, these competencies are important in the workplace and included in the exit level outcomes of accredited degrees. Development of these competencies can occur by giving Engineering students the opportunity of involvement in extra-curricular projects that develop such complementary competen-This paper discusses the Jozi Digital cies. Ambassadors Project as one such opportunity. The project was launched by the City of Johannesburg, and aimed to roll-out free Wi-Fi

to 700 000 Johannesburg residents who previously had no access to free public internet. A further aim was to provide training to these residents regarding how to access the free Wi-Fi and the online services offered by the City. 'Digital Ambassadors', unemployed young people who reside in the areas concerned, were appointed to undertake this training on behalf of the City. The University of Johannesburg, tasked with providing mentorship to these ambassadors, identified Engineering students who were appointed as mentors. Structured interviews with the mentors were conducted at different stages of the project. The focus of the interviews was on the students' motivation to participate in the project and their skills development. The development of complementary competencies was one of the factors that motivated the students to join the project and their involvement in the Digital Ambassadors project gave them opportunities to develop leadership and communication skills in a way that the formal university curriculum did not.

Developing a comprehensive teaching portfolio – A scholarly personal narrative

Authors: Swart, Arthur James

Organisations: Central University of Technology, South Africa

Academic teaching portfolios may be required by universities when they review the experience and skills of a prospective faculty member or when they review the application for promotion by current faculty members. Teaching portfolios are furthermore a significant contributor to the scholarship of teaching and learning, as it provides tangible proof of engagement. However, not all academics compile comprehensive teaching portfolios due to a lack of awareness of what is required or due to ignorance of its perceived value. The research question therefore arises: "How may academics develop a comprehensive teaching portfolio to accurately reflect their experiences and skills". The purpose of this paper is to present an academics personal perspective of how to structure and formulate such a portfolio that will provide tangible evidence of good teaching, personal experience and skills. The academic received a Commendation for Teaching from the Council of Higher Education in South Africa during 2015, thereby validating his submitted teaching portfolio as being comprehensive.

A scholarly personal narrative is used that may be linked to a constructivist research methodology that recognizes the validity and usefulness of a researcher's personal experience on a specific topic. The first-person voice is used in the development, gathering and analysis of information.

Three critical subsections of the teaching portfolio relates to one's own teaching philosophy, practice and evidence. The last subsection, teaching evidence, presents many sketches and photographs of the academic's teaching practice and achievements, accounting for more than 75% of the teaching portfolio. Each of the subsections are elaborated in the paper in an attempt to provide a guideline to new or struggling academics of how to develop a comprehensive teaching portfolio. A key implication of this study is that it may mitigate misconceptions of fellow academics regarding the structure and importance of teaching portfolios.

Student perceptions on academic feedback – a case study from Mechanical Engineering

Authors: Olwagen, Lienie; Swart, Arthur James

Organisations: Central University of Technology, South Africa

Engineering students need to receive effective academic feedback on their theoretical assessments, as it reinforces appropriate student behavior or thinking, informs students of their academic progress and provides further opportunities for student engagement and learning. However, some academics are prone to just provide a final grade on student written assessments, with no specific written comments on where the student succeeded, faltered or can improve! This environment may negatively affect student perspectives of what academic feedback really should entail, thereby disadvantaging students from recognizing their rights to request additional comments on their marked assessments.

The purpose of this paper is to highlight the perceptions of African engineering students with regard to what they think academic feedback really entails. A case study is employed along with descriptive statistics of the quantitative data. 66% of the 38 respondents believe that academic feedback entails brief and to the point comments. The majority of the students (76%) agreed that they do receive oral feedback on how to improve for their next assessment. However, 63% indicated that they received no written academic feedback at all! Results (75%)of the respondents) further indicate that more students value constructive feedback than critical feedback, as it will help them to avoid making the same mistakes in the future. It will also provide them with the opportunity to reflect on the quality of their assessments.

The gathered results may assist academics to identify ways of rectifying student misconceptions of what academic feedback really entails. This has the potential of empowering students with the knowledge regarding what type of academic feedback they may request with regard to their submitted assessments. It further has the potential of motivating academics to put forth more effort in providing constructive feedback on the assessments of undergraduate engineering students, to the benefit of students and universities.

(4G) Other Applications in Engineering Education

Chairs: Vaca-Cardenas, Leticia Azucena

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-20 08:30

English-medium instruction groups on Informatics Engineering. Results and comparison to conventional groups.

Authors: Más-Estellés, Jorge; Benlloch-Dualde, José V.; Gil-Vicente, Pedro J.; Gil-Salom, Daniela

Organisations: Universitat Politècnica de València, Spain

Since the School of Informatics at the Universitat Politècnica de València launched on 2010 the Bachelor's Degree in Informatics Engineering, a special teaching group (called ARA that stands for High Academic Performance) was set up, in order to attract high performing students. This group was characterized by high scores on previous years, by using English as the medium of instruction, and a lower number of students. In return, the students are preferred when asking for a mobility grant and they have a merit mention on their degrees.

The number of enrolled students, their average admission mark, dropout, academic performance and success rates were computed throughout the last five academic years. These results were compared with conventional groups and with a control group on two firstyear subjects.

Even though teaching methodology, teachers and assessment are independent on both subjects, their performance evolves in a parallel way. Then, the only reasons we found to explain the different academic performance are those coming from the lower number of students on ARA groups, enabling a higher student-teacher interaction. We think that the greater quantity of material available in English could also contribute to their best results.

We also think that belonging to this group, the students are encouraged due to the major attention of teacher, and the high performing classmates, some of them coming from foreign universities.

Our conclusion is that ARA groups help to increase the academic performance of students and they should be promoted on all the degrees.

Introducing Lean and Agile Methodologies into Engineering Higher Education

Authors: Caeiro Rodríguez, Manuel; Tsalapatas, Hariklia; Heidman, Olivier; Vaz de Carvalho, Carlos; Jesmin, Triinu; Manso, Mario

Organisations: Universidade de Vigo, Spain; University of Thessaly, Greece; Instituto Superior de Engenharia do Porto, Portugal; Tallin University, Stonia

Lean and Agile are currently the most popular and extended methodologies in engineering. They have been widely adopted in industry to reduce production costs, improve product quality and team efficiency, etc. Nowadays, it is desirable if not required that any graduate knew these methodologies in order to be prepared to work, as well as Information and Communication Technologies (ICT), as lean and agile methodologies are commonly implemented through ICT tools. This is actually one of the goals of Higher Education: preparing students to effectively transition into the professional world. In this regard, the LEAP project is aimed at achieving this by providing the students experience in emerging lean and agile methodologies, developing their skills and effectively integrating industry practices into higher education. In this paper and as a first step towards this goal, we present a study of the current situation of adoption of lean and agile methodologies in higher education in four european countries: Greece, Estonia, Spain and Portugal. This study is divided in two main parts: first, we attend to national policies, practices and strategies regarding linking of learning processes to industrial practices, specifically lean and agile. Second, we present current practices for exposing students to real world industry practices using ICT. This study set the basement for the design of ICT tools within the LEAP project.

A control system framework for reflective practice

Authors: Auret, Lidia; Wolff, Karin

Organisations: Department of Process Engineering, Stellenbosch University, South Africa; Centre for Teaching and Learning, Stellenbosch University, South Africa

Reflective practice in teaching is an important requirement for continuous improvement in professional education. In this work, we report on an approach to reflective practice which leverages the technical domain knowledge of the teacher - specifically that of engineering control systems. The structure, elements and properties of a typical control system are appropriated as a model (Control Systems Framework) for the teaching and learning of control systems in a Chemical Engineering qualification in South Africa. By considering the analogies of the various control system elements (and where these analogies break down) in the teaching and learning environment, reflection on teaching activities, as well as potential intervention design, is achieved. The CSF model is demonstrated in a particular case study, and the approach is shown to fit within the broader frame of design-based

research methods. The desirable properties of successful design-based research are determined from literature, and reflected on for this work.

Evaluation of Exer Learning Technology for Teaching Refugees. Teaching German as Foreign Language to Pupils with Migrant Background

Authors: Breitbarth, Kati; Menz, Monika; Grodd, Sarah; Lucht, Martina

Organisations: Fraunhofer Institut fo Digitale Media Technology IDMT, Germany

This paper describes the benefits of the connection between exercise, gaming and learning and examines the positive effects of so called exer-learning games - like HOPSCOTCH. It explores the research question wether HOP-SCOTCH could be a significant tool in educational institutions to support young refugees in German language acquisition. Firstly, a closer look at the benefits of the connections between exercise and learning is taken. In a second step, these benefits will be examined by the exer-learning technology HOPSCOTCH. For the evaluation, an application was designed to learn German language. HOPSCOTCH was deployed in special language classes for young refugees at two schools, and in mixed groups at one kindergarten with a high rate of children with migrant background. After a period of five months, several positive learning, social, phycological and cognitive effects have been observed. HOPSCOTCH proved to be a tool which supports the learning outcome and the formation of new social groups consisting of different nationalities and religions.

(5B) Systems and Technologies for Learning

Chairs: Al-Bahi, Ali M.

Room: 340 people plenary room with speaker and presidency table located in the basement at the right of the reception

Date and time: 2018-04-20 15:00

Work in Progress: Modernizing Laboratories for Innovative Technologies in Automotive

Authors: Kastelan, Ivan; Popovic, Miroslav; Vranjes, Mario; Velikic, Gordana

Organisations: University of Novi Sad, Faculty of Technical Sciences, Serbia; Faculty of Electrical Engineering, Computer Science and Information Technology, Osijek, Croatia; RT-RK Institute of Computer Based Systems, Serbia

Automotive industry is one of the fastest growing fields adopting the information and communication technologies (ICT). Responding to the needs of the automotive industry requires improving the education in ICT fields. This paper describes the recently started project with goals to modernize laboratories and develop graduate-level curriculum and study materials for automotive software engineering.

Low Cost Supportive Tool for Teaching Assistance in Formative Assessment Strategy

Authors: Daneti, Marllene

Organisations: Politehnica University of Timisoara, Romania

Formative assessment plays an important role for achieving a relevant education, due to its controlling function of the learning process. Yet, when working with a large number of students concomitantly, it is difficult to provide continuous feedback to the teacher, due to time limitations. This paper proposes a low cost, supportive technical system based on data logging and serial communication, which improves efficiency by reducing timings required for some routine operations in the evaluation work.

Sustainability SMART Indicators of Engineering Education for Sustainable Development

Authors: Al-Bahi, Ali M.; Soliman, Abdelfattah Y.

Organisations: King Abdulaziz University, Saudi Arabia

The purpose of this paper is to develop a coherent framework of SMART indicators for assessing and monitoring the sustainability of engineering educational process that targets sustainable development of the society. The indicators address the sustainability of the process as well as its impact on the sustainable development of the society. The approach is to find ways to achieve the sustainability goals of the society via a sustainable process by constructing measurable reliable indicators, which combine factors that affect the sustainability of an engineering education process, and those that which represent the impact of engineering educational process on the sustainable development of the society. The indicators reflect measures of the sustainability of the educational process starting from institutional strategic planning to the delivery of trained professionals and development leaders, while measuring the impact of the process itself on the environment, society, and economy. Developed indicators are intended to help in achieving the sustainability goals via sustainable high quality educational process. Indicators are constructed to map all the engineering institutions' activities and their impact on environment, society, and economy. The framework of indicators gives a broad picture of sustainability of

engineering education in general and the engineering education for sustainable development, in particular. Developed indicators facilitates assessment and monitoring of the institutional strategic planning and daily activities for sustainability.

Using the Visualization Tool SimReal to Orchestrate Mathematical Teaching for Engineering Students

Authors: Hadjerrouit, Said; Gautestad, Harald H.

Organisations: University of Agder, Kristiansand, Norway; Tangen upper secondary school, Kristiansand, Norway

Mathematics plays a crucial role in engineering education. It helps engineers to build the mathematical competence that is needed in a variety of engineering contexts. The recent development of visualization tools has created new opportunities for teaching mathematics in an engineering educational setting. SimReal is a new visualization tool for teaching mathematics. It provides opportunities for orchestrating classroom and individual teaching. This study uses a framework in the form of an 'orchestration chart' to assemble, configure, and exploit various artifacts with the intention of performing a didactic purpose. The intention of this paper is to use the framework to identify orchestrations that emerge in teaching mathematics for engineering students.

On Teaching Calculus for Prospective Engineers and Computer Scientists - A Case Study Monitoring of Six Semester Calculus at Frankfurt UAS

Authors: Logofatu, Doina; Andersson, Christina; Großkreutz, Damian; Muharremi, Fitore; Falkenberg, Egbert

Organisations: Frankfurt University of Applied Sciences, Germany

It is a common held perception that nowadays young engineers and computer scientists suffer from a lack of mathematical knowledge, especially capabilities to cope with practical tasks. This becomes quiet obvious when they are confronted with the assignment to practical tasks or while presenting their achievements. Nowadays, the math teacher faces complex issues like regarding the heterogeneity of the students' groups, the society's views towards mathematics, the overall workload, expectance, constant attendance or work behavior. In our Computer Science Study Program, the Calculus module was inserted starting with the winter term 2012/2013, additional to Algebra module for the first semester. The main reason was the missing knowledge in math basics towards the concepts needed for teaching other modules like Algorithms Analysis, Statistics, Optimization Techniques. Calculus was provided six times in our and the outcome is increasingly better, since the content, methods and framework became a standard. Especially the students' evaluation in the first runs provided useful insights how to improve the teaching attempt. We present in this paper methods and tools, as well as contents and statistics to the topic, by visualizing the methods, tools and activities implemented in this large class approach. We use charts and pictures took during the teaching to illustrate parts of the issues addressed in the teaching attempt.

(5C) Open Education and Machine Learning

Chairs: Leisenberg, Manfred

Room: 60 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-20 15:00

MOOC Dropout Prediction Using Machine Learning Techniques: Review and Research Challenges

Authors: Dalipi, Fisnik; Imran, Ali; Kastrati, Zenun

Organisations: Linnaeus University, Sweden; Norwegian University of Science and Technology (NTNU), Norway

MOOC represents an ultimate way to deliver educational content in higher education settings by providing high-quality educational material to the students throughout the world. Considering the differences between traditional learning paradigm and MOOCs, a new research agenda focusing on predicting and explaining dropout of students and low completion rates in MOOCs has emerged. However, due to different problem specifications and evaluation metrics, performing a comparative analysis of state-of-the-art machine learning architectures is a challenging task. In this paper, we provide an overview of the MOOC student dropout prediction phenomenon where machine learning techniques have been utilized. Furthermore, we highlight some solutions being used to tackle with dropout problem, provide an analysis about the challenges of prediction models, and propose some valuable insights and recommendations that might lead to developing useful and effective machine learning solutions to solve the MOOC dropout problem.

ACE Assisted Communication for Education: Architecture to support Blind & Deaf

Authors: Ulisses, João; Oliveira, Tiago; Escudeiro, Paula Maria; Escudeiro, Nuno; Maciel Barbosa, Fernando

Organisations: ISEP /GILT, Portugal; FEUP, Portugal

Deaf and blind students face serious challenges in education settings. Communication barriers are constantly present and arise naturally due to the use of different languages and different forms and channels of communication by the deaf community, the blind community and the rest of the students and teachers. Some deaf can read without difficulties but they often must resort to work arounds and context due to different grammar and semantics between sign and oral languages. Blind people rely on voice to communicate while deaf people rely on visual representations; these channels are independent and prevent any type of communication between these two communities.

An approach to design of the cyberphysical systems for engineering education

Authors: Veljovic, Aleksandra Milic; Matijevic, Milan Slavko; Nedeljkovic, Milos Srecko; Cantrak, Djordje Svetislav

Organisations: Faculty of Engineering at University of Kragujevac, Serbia; Faculty of Mechanical Engineering, University of Belgrade, Serbia

Cyber-physical systems are integration of physical and virtual reality. In this paper we propose design and use of one kind of cyberphysical systems in engineering education. In limited condition of use physical plants for experimental educational purpose, we can design and use virtual plants in real-time interaction with hardware for control, measurement, conditioning and acquisition of signals, etc. In our case hardware part of the system is PLC/HMI devices with connected DC or AC motors with integrated gear boxes and encoders. Virtual controlled plant is designed by LabVIEW software package and implemented on PC which is connected with PLC/HMI via NI USB 6008 AD/DA card and designed physical interface. Proposed approach is tested on several examples which include designing of experimental setup and virtual plant, and generating and implementing control law. The examples are: 1) typical discrete event system, 2) process control system, and 3) mechatronics system. These exercises are prepared for implementation in Go-Lab repository via local WEB Laboratory and for educational materials. Our intention is that students can find on the Internet portal a detail tutorial how can produce and use cyber-physical system for educational needs.

A Study of Integrating Remote Laboratory and On-Site Laboratory for Low-Power Education

Authors: AbuShanab, Shatha; Winzker, Marco; Brück, Rainer; Schwandt, Andrea

Organisations: Bonn-Rhein-Sieg University of Applied Science, Germany; Siegen University, Germany; Bonn-Rhein-Sieg University of Applied Science, Germany; Siegen University, Germany

This paper investigates how the learning objectives can be complemented by employing a remote system in order to improve teaching low-power digital circuits design. The lowpower design laboratory system that has been developed at the Bonn-Rhine-Sieg University of Applied Sciences is composed of two types of laboratories: the on-site (hands-on) and the remote laboratories to teach low-power techniques with laboratory exercises. The laboratory system offers online experiments that can be performed via the internet, using physical instruments, and obtaining real data. Power dissipation of the digital systems is influenced by specification, design, technology used, as well as operating temperature. Digital circuit designers can observe most factors during laboratory exercises in the on-site system and supplement the other factors during the remote system. The assessment methodology of this contribution describes teaching activities carried out during the summer semester 2015 using only the on-site system, and the summer semester 2016 using the on-site and the remote systems. The aim of this assessment is to study the achieved learning objectives, to evaluate the laboratory reports with and without the support of the remote system, as well as to analyse the usage of the remote system by the students. The assessment process and the students' opinions provide a very positive feedback on this approach and verify that the remote laboratory system is indeed a successful and effective complement learning tool to reuse the on-site laboratory remotely and also to achieve additional learning objectives that cover most conceptual theories in low-power digital circuits design.

MOOC Affordances Model

Authors: Economides, Anastasios A.; Perifanou, Maria

Organisations: University of Macedonia, Information Systems IPPS, Greece

Although there is a great interest on MOOCs, it is not clear what a MOOC should provide to learners enabling them to achieve their objectives. This paper proposes the MOOC Affordances Model (MOOC-AM) for characterizing a MOOC. The MOOC-AM consists of eight dimensions of affordances: 1) Massiveness, 2) Openness, 3) Interaction, Communication, Cooperation & Collaboration, 4) Personalization & Adaptation, 5) Autonomy, Choice & Control, 6) Support, Scaffolding, Help, Facilitation, Assistance, Feedback & Recommendations, 7) Mobility & Ubiquity, and 8) Accreditation, Certification & Assessment. In order to illustrate the application of the MOOC-AM, MOOCs on Programming in Python were examined regarding the affordances they provide. The findings reveal that none MOOC excels in all eight affordances. Learners, educators, designers, developers, and policy makers could consider this MOOC-AM to make appropriate decisions.

(5D) $\mathbf{E} \cdot \mathbf{Assessment}$ and new Assessment Theories and Methodologies

Chairs: Rasteiro, Maria Graca

Room: 50 people, theater style, 3 people presidency table, video projector and computer, area mezzanine up of the conference center

Date and time: 2018-04-20 15:00

Understanding the usage of online forums in engineering. A case study in industrial organization

Authors: Castillo Tello, Juan; Verdú Përez, Elena; Rainer, Javier

Organisations: Universidad Internacional de La Rioja, Spain

Conceptual understanding of the management of real situations and heterogeneous problems in manufacturing and engineering in general is one important competence in industrial organization. This paper describes a series of practical experiments conducted to determine how online discussion forums make an influence in the behavior of the students, the quality of the discourse and improve the learning performance.

The aim of this paper is to determine a practical and feasible way of using discussion forums as a learning complement in on-site classrooms in engineering. Research continues to focus on how to establish a procedure to implement forums as a learning tool in the School of Engineering.

Best Practises in E-Assessments

Authors: Pradarelli, Beatrice, Severine; Magid, Amani; Cieliebak, Mark; Benites, Fernando; von Grünigen, Dirk **Organisations:** University of Montpellier, France; New York University Abu Dhabi; University of Applied Sciences

This paper presents helpful guidance for lecturers who want to introduce e-assessments in their class. It is based on literature review and on an international survey that gathers insights and experiences from lecturers who are using eassessment in their class.

Digitalization in Engineering Education Research and Practice

Authors: Block, Brit-Maren

Organisations: Leuphana University of Lüneburg, Germany

Digitalization is the ongoing trend of recent years. It covers all areas of business, society and research. This paper makes a contribution to that discourse focusing on engineering education research and practice. The contribution aims at generating new insights in a threefold way: (1) by analyzing the significance of digitalization in the research area, (2) by describing an example of the implementation of digital methods in education practice, and (3) by presenting the theoretical and methodological framework of a course that covers the digital transformation and backlash effects on society. This approach generates empirically grounded knowledge on the state-ofthe-art and contributes to the translation of engineering education research to practice.

Towards more efficiency in tutorials: Active teaching with modular classroom furniture and movie-making project

Authors: Absi, Rafik; Lavarde, Marc; Jeannin, Laurent

Organisations: EBI, France

This contribution aims to share teaching experience in higher education. Methods were applied and assessed to improve teaching through active tutorials with modular classroom furniture and learning through play pedagogy with the movie-making project. These methods were evaluated from the analysis of both students' evaluation of teaching and module marks. In our tutorials with mobile furniture, students become active and actors. In a problem-based learning (PBL) approach, students work in group, they discuss about the problem and try to find the best way to find a solution with certain constraints (time, available help, ...). In the same way, making a movie to record the experiment and to find the adequate editing to make the movie clear is a very useful exercise to better understand the course and to give it meaning.

Tangible Programming Mechatronic Interface for Basic Induction in Programming

Authors: Cardenas Caceres, Pablo; Paredes Venero, Renato; Cuellar Cordova, Francisco

Organisations: Pontificia Universidad Catolica del Peru, Peru

The programming field is mostly taught through visual programming interfaces complemented with traditional computer hardware such as mice, keyboards, and others. Careers of the future will require strong programing skills, and nowadays around the world these skills are developed since childhood. In developing countries such as Peru, the programing skills are mostly acquired during university, and, in high school, the students use robotics kits that could be expensive to afford for public institutions. From the research literature it is observed that the concept of tangible programing instead of visual virtual programming could have a strong impact in the learning experience, particularly for children around six vears old. The present work details the design of a platform called FYO (Follow Your Objective), a low-cost tangible programing platform composed of a physical intuitive programming board, puzzle-based tangible blocks and

a zoomorphic mobile robot, which could be used for children around six years old, in order to teach and improve programing skills. The preliminary experiments and result of platform are evaluated and presented; results show that a tangible platform puzzle-based can improve children programming skills. Finally, future work for improvement is discussed.

(5E) Attracting and retaining practices in Engineering Education

Chairs: Kusmin, Marge

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-20 15:00

The socio-economic characteristics of the hometowns of the students. A basis for designing adequate strategies in order to atract, engage and retain students in UNITECs Faculty of Engineering and Architecture

Authors: Mena Arzú, Dania Valentina; Castro Valle, Claudia María

Organisations: Universidad Tecnológica Centroamericana (UNITEC); Universidad de Extremadura; Universidad Tecnológica Centroamericana (UNITEC)

This paper presents the results of an analysis made of the demographic and socioeconomic characteristics of the hometowns of the students belonging to UNITEC's Faculty of Engineering and Architecture. These specific characteristics may influence their possibility of enrolling and finishing their undergraduate studies. Therefore, they should be taken into account when designing specific strategies to attract, engage and retain such students.

Didactical Experiments with Smartphone Sensors

Authors: Langmann, Reinhard

Organisations: Duesseldorf University of Applied Sciences, Germany

The paper deals with the concept and implementation of an Android smartphone application in order to make the sensory data of a smartphone available in the IoT and then to use it for didactic experiments. After an introduction, the communication concept, implementation and some application examples for learning purposes are described. The paper concludes with evaluation results and an outlook on further planned work.

Motivating Students to Avoid Academic Dishonesty in Learning Engineering Courses

Authors: Raud, Zoja; Vodovozov, Valery; Petlenkov, Eduard; Serbin, Aleksandr

Organisations: Tallinn University of Technology, Estonia

The paper separates positive academic activities from deliberate fraud and offers an educational framework aimed to avoid academic dishonesty in engineering education, to remove factors that induce tricks, and to mitigate cheating incidents. The roots of misconduct are studied and their unintentional types are displayed. The measures and methods are demonstrated designed to prevent negative sides of plagiarism using motivation of students to learn engineering disciplines with competent involvement of copying, cloning, and other effective tools fostering education. Application of the designed approach in the courses supported by both the online and the traditional classroom modules show that students' self-motivation in learning has been greatly promoted, and their practical proficiency has been significantly improved. The insights from this

paper could be used by educators and learners to determine when it is pedagogically more effective to involve copying and cloning in instruction; by educational course managers – to adapt their systems; and by assessment tools developers – to provide better learning outcomes.

The support of European programmes in the Internationalization process of Engineering Courses

Authors: Jiménez-Castañeda, Rafael; Cipri, Katiuscia; Clavijo-Blanco, José Antonio; Moreno-Ruiz, Jesús

Organisations: Cadiz University, Spain; La Sapienza, Roma, Italy

The Internationalization process of Higher Education Institutions can find in the specific European programmes the instruments for the achievement of required objectives; the modernization of the didactic offer, the respect of transnational high quality standards, the promotion of the mobility of staff and students, accessibility and equity. DIEGO project, funded by the ERASMUS+, KA2 Capacity building in the field of higher education, aims at establish n. 6 innovative courses in n. 6 Latin American Universities in close collaboration with European partners. The new didactic offer, based on a preliminary analysis of local needs, has been elaborated jointly sharing the technical and economical knowledge of all partners, designing a suitable pedagogical approach based on theoretical technical and practical activities, including lessons in distance way provided directly by the European professors. DIEGO promotes the use of innovative tools, planning the development of n. 2 MOOCs on renewable energies and Innovative technologies that will be uploaded on one of the International Platform on distance learning.

Climate Change Mitigation Game

Authors: Wyrwa, Artur

Organisations: AGH University of Science and Technology, Poland

This paper presents a game-based learning used to familiarize students with the climate change mitigation strategies. The main tool used in the game is a paper form, which constitutes a scaffold providing the supportive learning material. It helps the students to better structure and understand the possible human responses to climate change considering political, technological and economical dimensions. The way the game is organized incentives them to take an active role. They are both collaborating and competing, which enhances interaction and results in their strong engagement in the learning process. Different scaffolding strategies such as peer interaction, questioning, repetitions, structuring, etc. have been incorporated in the game to achieve effective lecturing.

(5F) Games Engineering

Chairs: Ariadurai, Samuel Anbahan

Room: 140 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-20 15:00

Designing and Developing a Narrative Driven Serious Game for Teaching Information Theory

Authors: Heymann, Reolyn; Greeff, Jacob Jacobus

Organisations: University of Johannesburg, South Africa; North-West University

A serious game called "Codebreakers" was developed and designed for a fourth year Telecommunications module at University X. The goal of the game was to assist students to prepare for tests. The game was played for the first time in 2017 and received positive feedback.

During a collaborative design session with students, educational specialists, developers and the lecturer, it emerged that students would also gain from a serious game that not only allows them to prepare for tests, but also to explore and understand the content from the start. A linear and narrative driven serious games called "EnigmAI" was designed and

developed with this goal in mind. This paper explores the design and development of the new game, based on the experience gained from the previous game and from collaborative design sessions.

Interactive Serious Games as Electronic Engineering Capstone Projects

Authors: Heymann, Reolyn; Greeff, Jacob Jacobus

Organisations: University of Johannesburg, South Africa; North-West University

Capstone projects are projects that engineering students undertake in their final year of study. The capstone project gives the student the opportunity to showcase what she has learned during her studies, and gives the academic study leader the opportunity to test important skills necessary to be an engineer.

In this project, interactive, serious games for children are proposed as capstone projects for electrical and electronic engineering final year students. Students created an electronic device that would be attached to a child, record motion and then transmit that data to a computer game where the motion gets transformed into appropriate game interaction. The child thus plays the game by moving around. The aim of the game is to encourage the child to be an active participant and, in some cases, may also be used for the rapeutic intervention. In addition to meeting the required exit level outcomes and contributing to the growth of graduate attributes, these students' experiences were enhanced by being exposed to problems

outside the realm of engineering, being confronted by ethical and usability issues, being exposed to multi-disciplinary interactions and an opportunity to use their engineering ability in different engineering fields.

This paper describes the experiences of the study leaders and students in using a project of this nature in 2017.

Serious Games: Using Abstract Strategy Games in Computer Science 2 An experience report and lessons learned

Authors: Friss de Kereki, Ines; Adorjan, Alejandro

Organisations: Universidad ORT Uruguay, Uruguay

In this paper, we describe the use and lessons learned of "serious games", in particular "abstract strategy games", at freshmen-level in Computer Science 2 (CS2) course. In this course, the goals are that the student can analyze non trivial domains using methodology; design solutions, and implement them under the object oriented paradigm (OOP).

Since some years ago, we included this kind of games as a tool to teach the main concepts of the course. Here, we describe the CS2 course and abstract strategy games, including how to use them in the course and some examples. Moreover, we collected students' results and opinions, and also teachers' perspective. According to these data, its use is highly motivating and promotes learning. We offer also some lessons learned.

Gamification of Physics Themes to Nurture Engineering Professional and Life Skills

Authors: Panthalookaran, Varghese

Organisations: Rajagiri School of Engineering & Technology, India Gamification is a new generation tool for engaging students at different levels of education, motivating them to achieve the expected learning outcomes with greater ease. The fun element of gamification invites students to playfully engage and appropriate the concepts they learn at a higher level of educational achievement as stipulated in the Bloom's Taxonomy of Education. Further, the next generation students of engineering are expected to master their profession at a superior level in order to be able to match the requirements of future workspace, which are expected to be fully technology-driven, making the content of their learning subservient to the skills they imbibe. Hence they need to be equipped with adequate professional and life skills, which prepare them to easily adapt to the fast changing global job scenarios of the future. With the advance of industrial revolution version 4.0, powered by Artificial Intelligence, Internet of Things and 3-D printing, large number of jobs that demands human intervention is systematically delegated to the modern machines. Such paradigm shift in manufacturing in particular and engineering in general anticipates that the future engineers will need to equip themselves both in professional and life skills, so that their career as engineers and technologists are not critically challenged by the modern technology invasion. It will push future engineers to further focus on their human core-competence, which may not easily be taken over by autonomous machines. These changes will necessarily bring a paradigm shift in engineering education too, making many of the contemporary practices redundant. Creative thinking skills are expected to reign supreme. Along with that the conflict resolution skills, communication skills, team work, etc. will also assume importance. Correspondingly, engineering education has to be re-imagined, supporting the contemporary requirements of professional development of the students of engineering. The current paper reports some concepts developed in view of gamification of various themes and concepts related to Engineering Physics taught at Rajagiri School of Engineering & Technology, India. A novel approach of identification of the action verb behind a physical concept, prior to the development of appropriate games, is suggested in this paper, whereby students are allowed to experientially appropriate the concept behind the physical concept playfully. Care is also taken to develop games that will simultaneously cater to the development of both the professional and personal skills of the engineering students. Thus, gamification is visualized here as a project to engineer a deeper and experiential understanding of the physical concepts as well as to nurture the required skills of modern students of engineering, simultaneously. The paper does not present games that are fully developed. Rather, it presents a novel approach towards developing games based on themes of Engineering Physics, meant for developing better understanding of those concepts and at the same time aid the development of soft-skills, values and attitudes suitable for a successful life and career of an engineer.

Gamification as a didactic strategy in digital literacy Case study for incarcerated individuals

Authors: Páez Quinde, Cristina; Acurio Maldonado, Santiago; Infante Paredes, Ruth; Sanchez Guerrero, Javier; Viteri Toro, Maria Fernanda

Organisations: Universidad Tecnica de Ambato, Ecuador, Facultad de Ciencias Humanas y de la Educación; Pontificia Universidad Católica del Ecuador Sede Ambato, Escuela de Ingenieria de Sistemas

Nowadays gamification has achieved to improve the commitment, performance, and motivation of users by taking place on the development on a specific task using and incorporating game elements and interactivity allowing that each of the tasks be more attractive. Therefore, it has been able to apply gamification into software engineering; this with the goal of defining the results obtained with the use of gamification tools that promote the job market re-entry for incarcerated individuals.

Gamification has been attracting attention in all academic and professional fields; in different areas. Also, it has turned into a partly contradictory concept as it faces a division in its underdeveloped theoretical basis, academic value, and defined guidelines, which are standardized for an environmentally independent application, as in the technology that reflects the actions that human beings take in creating a system of social, cultural and labor interactions.

Therefore, education as a social fact looks for the integral formation of human beings; especially vulnerable groups such as the incarcerated individuals; cast away from society for violating some law or rule, doing time in correctional facilities where they are barred from activities that can improve their life project and life reinsertion. In this context, education represents a strategy for human development, as it can be done from the enhancement of technology in digital literacy to fulfill a predominant competency towards the management of entrepreneurship projects to diminish the level of recidivism; as well as that of the tutoring programs that are a fundamental support for the teaching practice inside correctional facilities.

(5G) Lifelong Learning, Special Needs and Non-Traditional Students

Chairs: Peixoto, Aruquia

Room: 50 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-20 15:00

Thinking about inclusion: Assessment of multiplatform apps for People with Disability

Authors: Larco, Andrés; Yanez, Cesar; Almendáriz, Vanessa; Luján-Mora, Sergio

Organisations: *Escuela Politécnica Nacional, Ecuador; Universidad de Alicante*

The use of Information and Communication Technology for People with Disability has become an opportunity to improve their education, however, the information and quality assessment of apps is unreliable. The objective of this research was to identify multiplatform apps quality assessed with Mobile App Rating Scale that could help People with Disability in their learning process. A systematic search was conducted with Preferred Reporting Items for Systematic Reviews and Meta-Analyses in specialized catalogs, Google, Google Play Store, and Apple App Store to identify apps for people with disabilities, such as autism. Down svndrome and cerebral palsy. Sixty apps were evaluated according to MARS items. The results were classified by disability, platform, and competences of life, each app has their own MARS score. The MARS total mean score had a good reliability which means the work of evaluators was objective according to MARS items and subscales. The list of apps with their respective MARS scores can be used to encourage therapists, parents, and People with Disability the use of them. The evaluation revealed apps had an absence of customization and interactivity, these features are important to improve the learning process for People with Disability.

Video reports by students in design based modules

Authors: Hertzog, Pierre Eduard; Swart, Arthur James

Organisations: Central University of Technology, Free State (CUT), South Africa

In design based modules many students find it

hard to highlight the finer details of their complex designs via written reports to the examiner. Video reporting was used by students in a design based module at the Central University of Technology in South Africa to present the working of their electronic projects to the examiner. The question may thus be asked "what are the student's perspectives of the use of video reports in a design based module and what benefits can be derived?". In this paper a case study was used in an investigation where both quantitative and qualitative data were collected regarding the use of Video reporting by students in the module Projects II at a university of technology in South Africa. The data collection instrument was an online questionnaire that was administered via Google forms. Quantitative data was gathered using a 5-point Likert-Scale, with the results presented in several bar graphs. Qualitative data was also gathered which sought to obtain student personal comments on the use of Video reporting. Benefits to the use of video reporting as indicated by students included better student satisfaction, better time utilisation, better presentations and reduced stress or anxiety among the students. These benefits have a positive influence on the learning process and can lead to an increased academic performance by students.

The Human Side of Big Data: Understanding the skills of the data scientist in education and industry

Authors: Mikalef, Patrick; Giannakos, Michail; Pappas, Ilias; Krogstie, John

Organisations: Norwegian University of Science and Technology, Norway

The past few years have seen an unprecedented explosion in the interest of organizations around the areas of big data and analytics. Yet, despite the great potential of new technologies, analytics tools and applications, the biggest problem practitioners face in leveraging these technologies is finding employees with the required skills. The objective of this paper is to empirically examine if there is a discrepancy in the skills that are required in today's organizations, compared to those available from graduates, and to provide a clearer understanding on the core areas that are of importance. To do so, we employ a mixed-methods approach using primary survey data from industry executives of 113 organizations, and a complementary 27 interviews from Information Technology (IT) and digital innovation managers. Results indicate that there is a wide gap between the needs of skills in the market, and those that are produced in academic curricula. We conclude our study by discussing how our findings can inform research, practice, and the development of market-suited curricula.

First Results of a new digitalized concept for teaching control theory as minor subject at a university of applied science

Authors: Rösel, Birgit; Köhler, Thomas

Organisations: OTH Regensburg, Germany; Martin-Luther-Universität Halle-Wittenberg, Germany

This paper presents a digitalized concept for teaching control theory as minor subject with an integrated approach for lectures, exercises and practical sessions and first results of the implementation at the department of electrical engineering.

The concept uses activating methods like blended learning and possibilities of digitalization of teaching implementing Just in Time Teaching and Peer Instruction. The base of the new concept is the concept of constructive alignment. The paper shows the use of this concept for the development of the exam.

According to the new concept for the whole module the author created specific teaching texts for the blended learning units. The paper explains the base for the decision which context will be handled by blended learning units. Furthermore there are lectures without blended learning and additional lessons and practical work units for further improvement of the competencies. The overall structure of the teaching module as well as the structure of the texts and the specifics of the practical work units are presented in the paper.

Furthermore this paper presents also the feedback of the students along with an accompanying scientific research over several semesters. The data obtained from the presented module is compared with the data from other blended learning approaches in Germany.

Cybersecurity Education and Training in Hospitals: Proactive Resilience Educational Framework (Prosilience EF)

Authors: Rajamäki, Jyri; Nevmerzhitskaya, Julia; Virág, Csaba

Organisations: Laurea University of Applied Sciences, Finland; Cyber Services Plc, Hungary

Healthcare is a vital component of every nation's critical infrastructure, yet it is one of the most vulnerable sector for cyber-attacks. To enforce the knowledge on information security processes and data protection procedures, educational and training schemes should be established for information technology (IT) staff working in healthcare settings. However, only training IT staff is not enough, as many of cybersecurity threats are caused by human errors or lack of awareness. Current awareness and training schemes are often implemented in silos, concentrating on one aspect of cybersecurity at a time. Proactive Resilience Educational Framework (Prosilience EF) provides a holistic cyber resilience and security framework for developing and delivering a multilateral educational and training scheme based on a proactive approach to cybersecurity. The framework is built on the principle that education and training must be interactive, guided, meaningful and directly relevant to the user' operational environment. The framework addresses capacity mapping, cyber resilience level measuring, utilizing available and mapping missing resources, adaptive learning technologies and dynamic content delivery. Prosilience EF launches an iterative process of awareness and training development with relevant stakeholders (end users – hospitals, healthcare authorities, cybersecurity training providers, industry members), evaluating the framework via joint exercises/workshops and further developing the framework.

Special Sessions

(SS01A) Gamification of Learning (Gamilearn'18)

Chairs: Arnedo-Moreno, Joan

Room: 140 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-19 08:30

The inclusion of game experiences in learning processes has been positively shown as a technique to motivate learners. Thus, experiences are introduced in courses by considering game design principles in non-leisure environments like the course structure layout (gamification or gameful design). This topic has garnered great interest in both academia and industry, as reflected by the amount of academic publications in the recent years, especially those showing case studies, hands-on experiences, or business growth of the enterprises specialized in gamification. This Special Session (Gamilearn'18) aims to cover all aspects of gamification including user studies, design frameworks, techniques and strategies, methodologies, tools and applications, ecosystems, analysis and assessment, personalization approaches, systems integrations, data management, architectures, innovations to market, as well as any work in progress. Our main goal is to bring together stakeholders for exchanging ideas and experiences and encouraging networking between academia and industry.

Effect of personalized gameful design on student engagement

Authors: Mora Carreño, Alberto; Tondello, Gustavo F.; Nacke, Lennart E.; Arnedo-Moreno, Joan

Organisations: Open University of Catalonia, Spain Many recent studies of gamification applied to higher education have demonstrated a wide range of positive results. However, most of them fail to consider any personalization factor for the student experience, despite recent studies having shown that gameful systems may be more engaging when they are personalized to each user. Therefore, the goal of this work is to investigate if gameful learning experiences can better motivate and engage students if they are personalized. In this way, we present the design and analysis of a personalized gameful learning experience within a Computer Network Design course. The general purpose of this study is to determine whether a personalized gameful learning experience affects both the students' behavioral and emotional engagement. The results of a descriptive analysis reveal that personalization works better than generic approaches in all items regarding the behavioral and emotional engagement of the students, being a promising standpoint to further investigate in subsequent studies.

Designing Effective Serious Games for People with Intellectual Disabilities

Authors: Tsikinas, Stavros; Xinogalos, Stelios

Organisations: University of Macedonia, Greece

Educating people with intellectual disabilities (ID) is a challenging process. Educators and researchers promote new methods to enhance the learning process of improving skills that people with intellectual disabilities have limitations. Serious games (SG) used in special education are considered a successful tool to benefit learning. To develop effective serious games, however, it is important to plan properly the design process. Therefore, design guidelines and principles should be thoroughly examined and accordingly selected. This paper aims to:

(a) study existing serious games design frameworks; (b) extract design guidelines and principles from existing serious games for people with intellectual disabilities (c) analyze the guidelines and principles, based on the elements of the design frameworks, which will then be used as basis of a design framework dedicated to serious games for people with intellectual disabilities.

Adapting LEGO® SERIOUS PLAY® methodology in Higher Education

Authors: Alzaghoul, Ahmad Fawaz; Tovar, Edmundo

Organisations: UPM-POLYTECHNIC UNI-VERSITY OF MADRID, Spain

Abstract— The huge amount of knowledge sharing in the process of education is increasing day by day. The typical normal methods of teaching courses remain the same even of the variety of techniques that are been used. This paper presents an attempt to find new learning methods, with the objective of improving the process of learning by measuring the changes in the behavior of learner. The approach is to apply the LEGO® SERIOUS PLAY® methodology to a designed online task to enhance the quality of learning process which can lead us to capture some quality attributes by studying the behavior of different learners while performing the task. This involves using techniques rooted in LEGO® SERIOUS PLAY® as exploratory tools for supporting student learning and change his behavior toward solving the task.

Interfaces and Services for Integrating Games and Game Components into Competence Based Courses within Learning Management Systems

Authors: Then, Matthias; Nussbaumer, Alexander; Wallenborn, Benjamin; Fuchs, Simon; Fuchs, Michael; Hemmje, Matthias **Organisations:** FernUniversität in Hagen, Germany; Technische Universität Graz, Austria; FernUniversität in Hagen; Germany; Wilhelm Büchner University of Applied Sciences, Pfungstadt; Germany

Development of an educational game that can be integrated into a course within a Learning Management System (LMS) is a challenging task both from the didactic and from the technical point of view. A thorough evaluation of a student's playing performance on LMSside requires informative user-specific data that have to be collected during gameplay and then transferred to the LMS. Standardized interaction technologies like Learning Tools Interoperability (LTI) specify mechanisms that can be applied for implementing functionality to exchange students' competence profiles and traces. The Knowledge-Management Eco-System Portal of the European funded RAGE (Realizing an Applied Gaming Ecosystem) Research and Innovation Action project provides capable utility packs for developing such functionality: besides a toolkit for creating competence based games that meet the requirements of Qualifications Based Learning (QBL), assets for storing individual player profiles and traces are available. Furthermore, tools for creating game-specific analytics are provided that can be embedded by LTI-compatible LMSs like Moodle. This paper is concerned with the integration of QBL-compliant competence based games into LMS-courses. A major topic is the description of an exemplar Moodle-plugin with its required functionality and interfaces to the above-mentioned RAGE assets. As the approach is not yet implemented, this paper remains on a conceptual level.

Opportunities and challenges of mobile location-based games in education, Exploring the integration of authoring and analytics tools

Authors: Xanthopoulos, Spyridon; Xinogalos, Stelios

Organisations: University of Macedonia, Greece

Mobile technology is becoming an integral part of student's life. The new mobile landscape shifts the educational ground demanding for innovative ways to create games for educational purposes. Location-based games provide new opportunities for effective learning in authentic environments. On the other hand, this game genre poses new challenges to educational practitioners that are closely related to technological advances and established pedagogical practices. The aim of this study is to investigate on the limitations and challenges of authoring tools regarding the support of new trends and standards. In the first place, we explore educational scenarios implemented in the form of location-based games and a general conceptual model that comprises common game elements is formulated. Secondly, two typical authoring tools that actively support location-based experiences and games are presented with a critical view with regard to the model presented. Finally, we draw conclusions in order to inform the design of next generation authoring tools. The platforms have been used successfully in educational settings by non-technical educational practitioners, however they miss the opportunity arising from integrating current trends and emerging standards focused on increasing learning technologies interoperability. Such trends afford game-learning analytics as the next generation move and new ways of integrating authoring and analytics tools need to be explored in order to make educational games even more impactful.

Exploring Digital Careers, Stereotypes and Diversity with Young People through Game Design and Implementation

Authors: Strachan, Rebecca; Dele-Ajayi, Opeyemi; Emembolu, Itoro; Shimwell, Joe; Peers, Matthew

Organisations: Northumbria University,

$United \ Kingdom$

A key issue for the digital sector is how to attract more young people, particularly those from under-represented groups to study computer science and digital technologies at higher education and beyond. The main aim of this study was to evaluate if a gaming environment can be used to generate interest and engagement among young people. Two further aims were to see if this approach could also be used to create a greater awareness of professional career roles in the sector and to explore diversity and stereotypes. Using an action research approach, a workshop was designed for use with young people where they were asked to design and develop a game. Embedded within this were activities to introduce career roles and challenge stereotypes, with a specific focus on gender and ethnicity. The results show that young people have a limited understanding of the roles involved in the game industry. The male children created male game characters while the female children created both male and female characters for their games. Females aspired to jobs in the health sciences while males aspired to a greater range of STEM careers. The workshop is currently being extended and developed to create a more in-depth intervention, building on the results from the research to date.

(SS02) Open Educational Resources

Chairs: Llamas Nistal, Martín

Room: 60 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-19 08:30

Open Educational Resources (OER) are teaching, learning and research materials, delivered in any media, that are under public domain or licensed openly, allowing them to be used or adapted by third parties. OER had been developed for more than 15 years in the educational field, based on the principles of open movement and inspired by free software. International institutions such as UNESCO or the European Union are making a major effort to develop this concept, which involves not only a new type of resource, but a model of personal, institutional and gubernamental involvement. OER are seen as an opportunity for teacher innovation through their empowerment as co-creators, who are offered the opportunity to reuse and adapt existing resources. From a practical point of view, the concept of OER is being favored by the development of new applications and solutions that promote the user's adoption: open formats, open source applications, open licenses such as Creative Commons, social networks, repositories, etc.

OER Special Session seeks to bring together OER researchers, activists, teachers and stakeholders, to present theoretical, methodological, technical or empirical research on OER and related issues. We seek, in particular, a look at OER current main challenges.

The 2017 Ljubljana OER Action Plan provides recommendations to stakeholders in five strategic areas, namely: building the capacity of users to find, re-use, create and share OER; language and cultural issues; ensuring inclusive and equitable access to quality OER; developing sustainability models; and developing supportive policy environments.

OER Special Session it is hoped to be able to give visibility to the actions that in these five strategic areas are being developed in different contexts and languages, giving global diffusion, as well as greater international articulation to them.

Learning Microelectronics with Open Educational Resources in the Cloud

Authors: Raleva, Katerina; Stankovski, Mile; Gochev, Ivan; Nadzinski, Gorjan; Chavdarov, Risto **Organisations:** Sts Cyril and Methodius University, Faculty of Electrical Engineering and ITs, Skopje, Macedonia, Macedonia, Former Yugoslav Republic of

The Micro-Electronics Cloud Alliance (MECA) is a European project in which eight higher education institutions and 8 enterprises are developing e-learning materials in the field of microand nano-electronics. Ss. Cyril and Methodius University – Skopje, Macedonia as a partner organization in the project participates in almost all project activities such as, need analysis, specification and development of the cloud teaching system, development of courses, conduction of pilot tests and local dissemination. The paper describes the development of two courses for learning microelectronics with open educational resources shared in the cloud.

Educational Needs and Open Education Resources in Micro- and Nanotechnology

Authors: Imenes, Kristin; Aasmundtveit, Knut E.

Organisations: University College of Southeast Norway, Norway

To keep up with the rapid development within micro- and nanotechnology, and to cover the wide range of specialized topics, there is a need for higher education institutions to collaborate and to share knowledge to give the students the competences and skills that the industry requires. The NanoEl project aims to share courses between European and Asian higher education institutions, in total 11 partners, through open education resources. The paper reports on results from three surveys targeting the industry needs for competence, the universities' need for and motivation to use open education resources and students' desires and interests in utilizing open education resources within micro- and nanotechnology. The results provide valuable insights and input to the development of the open educational courses in the NanoEl project.

Educational resources with digital contents for pedagogical and research formation in technologies of knowledge and learning}

Authors: Caviativa Castro, Yaneth Patricia; Jaramillo, Valentino; Menéndez Mora, Raúl Ernesto; Ramírez, Germán Augusto; Beltrán, Adan

Organisations: Universidad Manuela Beltrán, Colombia

When teaching in education, we often confront pedagogical challenges due to continuous changes in technologies and adjustments to curriculum in academic programs of information technologies and computational sciences. These emerging technologies require of a student to appropriate of new challenges, concepts and models for their performance in their labor. An approach to achieve this is through courses or diplomats, looking for having a professional and informed future according to the vanguard of changes in new technology. Herein, a cooperative learning centered educational experience is presented with design, development and implementation of a diplomat. Five virtual objects were used. A case of study was used as qualitative and descriptive research model. Results were positive in the construction of significant knowledge as well as in the characterization of collaborative learning in evaluating category.

Recommendation of educational resources to groups: a game-theoretic approach

Authors: Papamitsiou, Zacharoula; Economides, Anastasios A.

Organisations: University of Macedonia, Greece

In collaborative learning contexts, recommending those educational resources to groups of learners that will satisfy all group members, is more complex than recommending to individuals.Instead of merging individual profiles or fusing individual recommendations, this paper follows a game-theoretic perspective for solving conflict of interest among students and recommending resources to groups in online collaborative learning contexts: the group members are the players, the resources comprise the set of possible actions, and maximizing each individual member's satisfaction from the selected resources is a problem of finding the Nash Equilibrium. The comparative evaluation of the suggested approach to other stateof-the-art methods provided statistically significant results regarding the error in predicted group and individual satisfaction from the recommendation and the goodness of the ranked list of recommendations.

Using Laboratory Examination to Assess Computer Programming Competences -Questionnaire-based Evaluation of the Impact on Students

Authors: Hammer, Sabine; Hobelsberger, Martin; Braun, Georg

Organisations: University of Applied Science Munich, Germany

The main goal of an introductory programming course for computer scientists is to develop programming competences. The question arises how to assess those competences. As there are concerns, if written and oral examinations are valid exam environments for students to demonstrate their programming skills, there is a need for an alternative exam type. As lab exams represent a valid, reliable, efficient and competence-oriented assessment method, we assume that they provide an important contribution to our presently existing set of assessment methods. In this paper, we present the motivation and goals for the use of lab exams and provide background information on the course and environment we applied it on. Furthermore, results of a questionnaire-based study are demonstrated, where we analyzed

how students experience this new exam type, as for example if they value the benefit of validity, accuracy and fairness and how they evaluate the lab exam as a possibility to measure action-related competences. In addition, we identified factors related to the students' possibility to show their programming competences in the lab exam. Finally, we will conclude that computer based laboratory examination is a meaningful way to assess relevant computer programming competences.

(SS03) Computational Thinking (CompThink)

Chairs: Robles, Gregorio

Room: 50 people, theater style, 3 people presidency table, video projector and computer, area mezzanine up of the conference center

Date and time: 2018-04-19 08:30

The inclusion of computer programming and computational thinking (CT) skills in the school curriculum is one of the main trends in the educational landscape worldwide. The movement to bring these skills to education has been led by different stakeholders, including governments, policy makers, main figures of the software industry, non-profit organizations, educators and families, among others.

This Special Session (CompThink'18) aims to cover all aspects of CT including user studies, design frameworks, techniques and strategies, methodologies, tools and applications, ecosystems, analysis and assessment, personalization approaches, systems integrations, data management, architectures, innovations to market, as well as any work in progress. Our main goal is to bring together stakeholders for exchanging ideas and experiences and encouraging networking between academia, public administrations and industry. Learning Programming through Design: An Analysis of Parametric Design Projects in Digital Fabrication Labs and an Online Makerspace

Authors: Chytas, Christos; Tsilingiris, Alexandros; Diethelm, Ira

Organisations: University of Oldenburg, Germany; Aristotle University of Thessaloniki

Abstract—The introduction of programming in K-12 can also include elements of other STEAM (Science, Technology, Engineering, Arts, Mathematics) subjects like engineering design and mathematics. Parametric Design is a design paradigm which is often related to architecture. Emerging technologies like additive manufacturing (3D printing) and modern CAD (Computer Aided Design) tools have enabled manufacturing of complex parametric designs not only by professionals but hobbyists and youth as well. In this paper we present our empirical investigation on how parametric design and digital fabrication tools can support programming learning actions. To investigate the potential of parametric design in programming learning activities, we analyzed code of parametric design projects from a popular online makerspace and workshops that took place in two digital fabrication labs and an informatics school lab. In total 45 students participated in our workshops and developed code to generate more than 100 3D models. while each participant had the opportunity to 3D print at least one artifact. We designed, implemented and evaluated the workshops using mixed qualitative methods to triangulate the data. The results showed that the parametric design tools that we used were well suited for participants to understand core principles of programming (loops, conditions, variables, functions) and engineering design, bringing unique advantages to understanding programming concepts through the visualization of the generated 3D models. Moreover, the participants seem to have understood how to use programming concepts like decomposition and indentation to designate logical blocks in

the parametric design code. However, in some cases more advanced concepts were understood only on a surface level with the participants using commands without understanding the full functionality of their projects. Therefore, we present some critical remarks on parametric design and digital fabrication in educational context and their integration with programming, engineering design and mathematics.

Computational Thinking Through Modeling In Language Lessons

Authors: Sabitzer, Barbara; Jarnig, Maria; Demarle-Meusel, Heike

Organisations: Johannes Kepler Universität Linz, Austria; Alpen-Adria-Universität Klagenfurt, Austria

In contrast to the field of computer-supported computer-assisted language or learning (CALL), which has been investigated intensively for the last decades since the beginning of e-learning and technology-enhanced learning, computational thinking and computer science concepts are not quite common in the context of language lessons. Computational thinking is a problem solving process that, at first sight, has not much to do with language learning. However, as demanded by Jeannette Wing in 2006, it should be taught to everyone like reading, writing and mathematics. By introducing computational thinking in language lessons e.g. through modeling we could "kill two birds with one stone": On the one hand, we can teach computational thinking and basics of computer science at all school levels even if there is no related subject, e.g. in primary schools. On the other hand, computational thinking tools like modeling can support language learning in different ways and help to train text comprehension, to acquire and elaborate vocabulary or to visualize grammar rules etc. This paper describes some creative possibilities of introducing computational thinking through modeling in language lessons in primary and secondary education. Besides best

practices, it further presents some experiences and results gained from teacher observation, interviews and informal feedback from students and teachers.

Perceptions of Computing among Children after a Hands-On Activity: a Pilot Study

Authors: Henry, Julie; Dumas, Bruno

Organisations: Université de Namur, Belgium

Many children hold an incomplete perception of what computing is, leading to a lack of interest in Information and Communication Technology (ICT) studies. In order to address this challenge, a workshop was developed to expose children aged 12-14 years to core concepts in computing by letting them manipulate widespread tangible embedded systems. With the help of qualitative surveys, the effects of this workshop on middle school students' perceptions of computing were examined. The results indicate that children, especially girls, perceived the computer as a central element of computing and not primarily as a tool. However, the proposed two-hours long workshop seems to influence the children's perceptions: they spoke about programming, electronic/electricity and creativity.

Integration of Computational Thinking Skills in STEM-Driven Computer Science Education

Authors: Burbaite, Renata; Stuikys, Vytautas; Drasute, Vida

Organisations: Kaunas University of Technology, Lithuania

In the context of Computer Science (CS) education, one of the most important goals is the development of computational thinking (CT) and problem solving skills. Computational thinking skills are closely related to the CS concepts and approaches. These skills cover fundamental programming concepts such as task decomposition, abstractions and generalization, data structures and algorithms. On the other hand, CS education challenges, promote the search for new educational tools, methods, activities and resources. Consequently, CS education should be extended by adding the STEM (Science, Technology, Engineering and Mathematics) paradigm principles. The aim of this paper is to show how STEM-driven CS education supports and ensures the development of computational thinking at the high school. We present the already published STEM-driven CS education approach aiming at extending it by introducing a model to assess student achievements, according to the revised Bloom's taxonomy in the connection with CT skills. As a practical implementation, we describe a curriculum of Programming Basics at the high school with respect to STEM-driven aspects and CT skills. We introduce two case studies implemented in the real educational environment. They provide the evidence of availability of our approach.

Keywords— Computational Thinking; STEM; STEM-Driven education; Computer Science education; STEM-driven CS education, Revised Bloom's Taxonomy.

Development and Assessment of Computational Thinking: A Methodological Proposal and a Support Tool

Authors: Fuentes Pérez, Alexis Daniel; Miranda Valladares, Gara

Organisations: Universidad de La Laguna, Spain

Currently there are several platforms and initiatives to promote computational thinking. However, no one has been found that covers all the concepts and requirements involved in the development and later quantitative evaluation of the achieved development. In this work, we propose not only a software tool but also a methodology which goes from the development and monitoring of activities to the measurement of the skills developed by the students. Such a methodology will allow us for the generation of reports about the progress observed throughout the process. Once the methodological framework was defined, a web platform has been developed, thus providing a global support for the implementation of this methodology. The web platform has a simple and intuitive design that allows an easy use of it for pre-university students and teachers who do not necessarily have advanced computer skills. The tool will allow quantitative results to be obtained on the possible advantages that computational thinking offers in relation to the development of some cognitive abilities such us those related to problem solving.

(SS04) Inclusion and Diversity in Engineering Education – IDEE'18

Chairs: Peixoto, Aruquia

Room: 50 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-19 08:30

Engineering should attract, promote, foster and retain talents, considering that individuals are different and they can have characteristics that can require flexibility in the education system in order to

guarantee equal opportunities of anyone regardless their gender, race or condition. These characteristics can make the developing of their skills more challenging for the students and also for the educational institutions and their professionals.

Some of these characteristics can have a physical reason, such as deafness or blindness, other can be neurological, like autism or attention deficit hyperactivity disorder (ADHD), and other students can be part of groups that are still underrepresented in academia, like women, or they belong to some minorities or ethnical groups.

The IDEE'18 at EDUCON 2018 aims to start a discussion and a reflection about the diversity and inclusion in Engineering Education (EE), identifying the problems and proposing solutions. It also wants to create a bridge from schools to universities, highlighting that many problems that are visible in universities are the results of base problems that appear in early stages of education.

This special track wants to promote new ways to face and deal with the problem of the lack of representativeness in science, technology, engineering and math (STEM).

3D printing of microscope slides for visually impaired university students

Authors: Marenzi, Elisa; Danese, Giovanni; Gandolfi, Roberto

Organisations: University of Pavia, Italy

The paper presents a collaboration between the Microcontrollers and Biomedical Instrumentation Laboratory and the University Service in charge of providing assistance to disabled students (in Italian, Centro Servizio Assistenza e Integrazione Studenti Disabili e con DSA – SAISD). The aim is to give visually impaired students additional tactile tools to integrate their residual visual information. In particular, 3D printing techniques allow developing models of 2D images by enhancing useful details with different levels of height. Students of Medicine Faculty have evaluated the first prototypical 3D printed objects with positive results. In fact, microscope images of tissues are particularly complex due to their high level of details and thus they represent a good starting point to verify the approach. Moreover, the same kind of figures, together with organs (healthy and pathological) can be used not only in the medical area, but also for biomedical engineering students; therefore, it can be considered as a first outcome for the successive step of 3D

printing images in additional different engineering areas.

Knowlegde management for the cocreation of educational material by high ability students, teachers and parents

Authors: Meneses-Ortegón, Juan Pablo; Jové, Teodor; Fabregat, Ramon; Uribe-Rios, Mery Yolima

Organisations: Universitat de Girona, Spain

Implement a co-creation process in order to create resources for high ability students involve a set of activities, tools, documents and document version control but also create information and knowledge with the interaction between teachers, students and parents.

When the knowledge of a co-creation process is managed the processes or activities developed create innovative resources that support the needs of students. In this project was used the knowledge management to manage important items of process like communication between all member of process, storing and visualization of knowledge and manage of activities and contributions so that the information and knowledge can be share.

For manage the contributions of the participants of process and the activities, an approach with two perspectives is presented. The first perspective is a theoretical model where it is showed the way to capture and store the knowledge of educational material co-creation process as contributions and activities in order to share this and the second perspective is a technological perspective which uses information technologies to support the educational material co-creation process.

Co-CreHAs: Co-creation process for enrichment activities to high ability students

Authors: Uribe-Rios, Mery Yolima; Jové, Teodor; Fabregat, Ramon; Meneses-Ortegón,

Juan Pablo

Organisations: Universitat de Girona, Spain

Motivating the average student to learn is already a challenge, but motivating the high ability student can be even more so. This paper describes an effort to support and motivate these students in particular, through the design of a co creation process. In this process high ability students help to create their own learning activities and where some of their special characteristics and skills can be empowered by giving them activities and responsibilities, and including their own personal data, such as interests, in the co creation process.

Research-based Recommendations for Creating an Inclusive Culture for Diversity and Equity in Engineering Education

Authors: Walden, Susan E; Trytten, Deborah A; Shehab, Randa L

Organisations: University of Oklahoma, United States of America

The Research Institute for STEM Education (RISE) brings together a multi-disciplinary research team whose mission is to study the complex array of factors contributing to diverse students' successful academic experiences in science, technology, engineering, and mathematics majors (STEM) in the United States (U.S.). Utilizing a combination of narrative and artifact analysis, RISE develops recommendations to educators and academic policy makers based on those factors. RISE also strives to promote a more equitable and diverse cultural climate within engineering education. This paper will review the recommendations made during fifteen years of research on equity in U.S. engineering education for consideration by engineering educators working in other cultural contexts. The recommendations can be loosely categorized into seven domains: communication, college culture, department culture, classroom culture, facultystudent interactions, student-peer interactions, and academic pathway.

Inclusion of gender perspective in Computer Engineering careers: Elaboration of a questionnaire to assess the gender gap in Tertiary Education

Authors: García-Holgado, Alicia; Mena, Juanjo; García-Peñalvo, Francisco J.; González, Carina

Organisations: GRIAL Research Group, University of Salamanca, Spain; Institute for Women's Studies, University of La Laguna, Spain

Gender inequality is a global problem present in all facets of life to a greater or lesser degree. In the fields of Sciences, Technology, Engineering and Mathematics, both in career and work contexts, the gender gap continues. The percentage of women who study or work in the technology sector is around 25% according to different international reports. The incorporation of gender studies in the curricula is considered one of the main actions to close the gender gap in tertiary education. Education programs should approach conceptual mismatches between gender or sex and change its foundations to guarantee equal education for any person by limiting the influence of social stereotypes and dominant culture. There are few studies that aim at describing what is the main stream viewpoints among students from research instruments previously validated. This work describes the process to elaborate a questionnaire on gender perspectives and its validation in order to describe what students of Computer Engineering careers think and what changes can be implemented accordingly in future education programs to close the gender gap.

Coaching Program for Academic Success: Promoting Equal Opportunities for Engineering Students

Authors: Shacham, Miri; Ben-Yehuda, Margalit

Organisations: ORT Braude College of Engineering, Israel

The paper examines a new Personal-Academic Coaching (PAC) Program for promoting students' self-efficacy and academic success, which was developed and implemented in a leading engineering college in Israel located in northern periphery, and seeking to increase accessibility to academic education. The college accepts students from diverse, multicultural backgrounds.

The PAC program has two main goals: to promote students' personal and academic success, and to reduce dropout rates.

The Coaches are 25 college lecturers who were especially trained in this coaching program.

Population: 222 Engineering students who had failed in their first year, participated in the research during 2015-2016. 46 students had participated in the PAC in individual weekly coaching encounters with a lecturer-coach, for one semester.

Research aim: The research investigates the PAC program's contribution to students' learning skills and academic achievements.

Research design: The research examined the academic achievements of students who participated in the PAC and those who did not, in the end of the first year, and in the end of the following two semesters.

In-depth interviews were conducted with 15 students to examine their perceptions regarding the PAC contribution to their academic success

The research findings :

1. The PAC program contributed to improving academic achievements of studentschanging from an unsatisfactory academic status to a solid one that allowed them to continue their Engineering studies, thus preventing drop-out .

2. PAC allows students to develop tools for efficient learning, effective selfmanagement and constructive coping with situations of pressure and overload in academic studies as well as on a personal level.

The Teaching and Learning Center and College Management find these findings to be of the utmost importance in supporting the policy and the reasons to allocate resources to these programs for promoting equal opportunities and advance students from diverse backgrounds in the periphery.

(SS05) IT and Engineering Pedagogy" – ITEP'18

Chairs: Restivo, Maria Teresa

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-19 08:30

I t's a good tradition that, the International Society for Engineering Pedagogy (IGIP), organizes Special Tracks @ EDUCON Conferences – the ITEP series, ITEP'xx.

ITEP'18 @ EDUCON 2018 traditionally aims to offer an open discussion and a reflection in the use of Information Technologies in Engineering Education (EE) and their appropriate Pedagogy. It also intends to foster the involvement in continuing education, bridging the gap between higher education and learning on the workplace by also focusing on the IT use in lifelong learning and training. At K-12 level this session intends to evaluate the progress of IT in fostering the engagement of younger people in the field of science, technology, engineering and math (STEM). It is also important to understand and to discuss the role of EE in order to promote the technological, product and industrial innovation, developments for people with special needs, for health and for ageing, not ignoring the Key components of any M2M system within IoT.

At any level it is important to evaluate the IT power in facilitating the collaborative work everywhere.

Guidelines for Effective Online Lab Assignments: A Contribution to the Discussion

Authors: Zvacek, Susan; Restivo, Maria Teresa

Organisations: Higher Education Consultant, United States; University of Porto, Portugal

This article proposes a set of guidelines to inform the development of high quality laboratory assignments for implementation with virtual- or augmented-reality applications or remotely located equipment. The suggested criteria are based on validated instructional design practices and accreditation standards for engineering degree programs, and can be used to evaluate the design of laboratory instruction, as well. An example assignment is used to illustrate how the specific components of the proposed guidelines might be operationalised to design a new assignment or to improve an existing one. The authors anticipate multiple iterations of these criteria and welcome constructive feedback for their improvement.

Physical Computing, Computational Thinking, and Computational Experiment in Engineering Pedagogy An implication for the Engineering Education Epistemology

Authors: Psycharis, Sarantos; Kalovrektis, Konstantinos; Sakellaridi, Eva; Chatzarakis, George; Oikonomopoulou, Martha **Organisations:** ASPETE and Visting Professor Huddersfield University, Greece; School Teacher, Levadeia; Doctoral Researcher, UCL, Institute of Education; ASPETE; Mathematics teacher

The aim of the present article is to investigate the impact of physical computing on engineering education epistemology when the methodology of the computational science is implemented. We argue that computational experiment can be applied to engineering pedagogy, when physical computing activities are embedded in the curriculum for postgraduate students and in-service teachers and can be also be applied effectively to pedagogical training of prospective teachers. In order to investigate the impact on engineering education epistemology, physical computing software applications were developed by students that combined algorithms, pattern recognition and decomposition activities embedded in the applications as dimensions of the computational thinking according to the STEM epistemology. The present article contributes to rigorous research conducted in engineering education and STEM education by putting forward a set of questions asked in structured interviews, which can be answered empirically through a postgraduate course, linking in this way, research to relevant theoretical concepts. The results, although preliminary in nature, show that by engaging teachers through their existing pedagogical courses in the practical epistemology form of the computational experiment methodology, is a strategy that is much more likely to succeed in increasing the interest and appeal of engineering pedagogy and strengthen teachers' epistemological beliefs about STEM and engineering epistemology.

Entrepreneurial Intentions in the field of IT: The role of gender typed personality and entrepreneurship education

Authors: Sitaridis, Ioannis; Kitsios, FotisOrganisations:University of Macedonia,

Greece

Entrepreneurship is considered as a major motor behind economic development and innovation. Tertiary students are one step away from taking serious career decisions and as a result, a large number of articles try to decipher the mechanisms behind the development of their entrepreneurial intentions. Personality traits, factors of the social environment and the role of entrepreneurship education are among the factors investigated by previous research. However, entrepreneurial intentions in the field of Information Technology remain understudied. In this research drawing from gender schemas theory and the theory of planned behavior, we investigate the impact of gender typed personality and social norms in conjunction with the role of entrepreneurial education. The sample consists of tertiary Information Technology students. In contrast to previous research, social norms have a significant impact on entrepreneurial intentions, in comparison to entrepreneurial education which has a marginally weaker effect. Additionally, certain personality traits stereotypically associated with the masculinity have a major predicting ability on these intentions. The findings have valuable implications for educators and entrepreneurship course designers.

Solar Decathlon ME18 Competition as a "learning by doing" experience for students. The case of the team HAAB

Authors: Fantozzi, Fabio; Leccese, Francesco; Salvadori, Giacomo; Spinelli, Nicola; Moggio, Martina; Pedonese, Chiara; Formicola, Luca; Mangiavacchi, Elena; Baroni, Marco; Vegnuti, Stefano; Baldanzi, Valeria; Fontani, Marina; Mori, Giulia; Forassiepi, Roberto

Organisations: University of Pisa, Italy

HAABitat is the name of the project developed by a team of students from three different Italian Universities: the University of Pisa, the University "D'Annunzio" of Pescara, and the Second University of Naples. The aim of the project is to design, build and test an innovative self-sufficient house, which works with the sun as the only source of energy, employing advanced technologies and sustainable materials. HAABitat is one of the finalist projects of the Solar Decathlon Middle East competition, where students from all over the world challenge, to achieve the best "solar house", which combine efficiency, comfort, engineering, and architectural design to sustainability. Students of Team HAAB, supported by professors of the three Universities, have the chance to complete the knowledges learned in their course of studies with a practical application, relating to professionals and companies, in order to learn how to deal with responsibilities and challenges the world of work introduces. The aim is to reach a thorough education, which involves the whole aspects of the product design and realization, with a "learning by doing" experience.

ACTIVE METHODOLOGIES IN ED-UCATION OF ELECTRONIC IN-STRUMENTATION USING VIRTUAL INSTRUMENTATION PLATFORM BASED ON LABVIEW AND ELVIS II

Authors: Quezada Pena, Jose Roberto; Cunha de Oliveira, Jefferson William; Da Costa Neto, Manuel Leonel; Neves Rodrigues, Luis Henrique

Organisations: Federal University of Maranhao - Brazil, Brazil

There are numerous publications on the need to introduce innovative teaching methodologies in the classroom, seeking greater commitment and involvement of students in the teachinglearning process. To make effective the methodological reformulation of a certain subject of study is not a trivial task for teachers of the areas of Sciences and Technology, particularly with respect to Engineering Education. The process demands the appropriation of academic and methodological techniques in the areas of teaching and pedagogy. After overcoming the pedagogical reformulation of a given discipline, through the elaboration of a new Instructional Design (ID) project, a new and challenging stage arises, to operationalize the new ID Project through the use of Learning Management Systems (LMS). This paper presents a proposal for the application of ID techniques and Bloom Taxonomy, together with Digital Information and Communication Technologies (DICTs), to promote an Active Learning in the contents of practical teaching of the Electronic Instrumentation discipline. Active Methodologies such as the Flipped Classroom and the Virtual Instrumentation concept, consolidated by the use of NI LabVIEW software integrated with the National Instruments NI-ELVIS II Benchtop, which make up an efficient set for data acquisition and analysis, instrumentation, systems control and consequently for engineering teaching. In order to implement the ID Matrix in the classroom, its integration with an LMS (MOODLE) is presented, to establish a link between MOODLE and the teacher's needs in terms of implementing the instructional design proposal. This experimental teaching proposes to innovate when trying to take the student out of his passive state and put him in an active state, making him the protagonist of his education and changing the scenario of study in the classroom.

(SS06) Learning Analytics Trends and Challenges in Engineering Education. SNOLA Special Session

Chairs: Caeiro Rodríguez, Manuel

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-19 08:30

Learning analytics brings together a series of methodologies and tools that allow teachers and researchers to obtain a lot of information about the learning of our students from the data collected in learning systems. Thanks to the learning analytics, teachers can carry out a monitoring of the actions in the learning environments, in order to detect students who need attention, problems in the development of lesson plans, difficulties with the resources offered, etc.

During the last years, learning analytics has become increasingly present in educational settings, but it is still a recent research field. Techniques, tools and methods are still under development and experimentation in order to apply them in educational environments, also in engineering education. Education in engineering disciplines usually involves practical and collaborative activities, such as team-project development or the use of simulators, that introduce specific conditions and opportunities for the application of learning analytics solutions. Learner actions and progression need to be considered in a broader way, involving the use of tools to support the management and performance of open and collaborative activities. Also, assessment is many times approached in new ways, for example with rubrics of peerassessment. These are trends that are being explored in the context of learning analytics in engineering education and that can bring many benefits both for learners and teachers.

The goal of this special session is to gather new research about the development and application of learning analytics solutions in the context of engineering education. Researchers and educational technologists are invited to submit original research and work in progress that further contributes to advances in the field. Both qualitative and quantitative work related to the topics are welcomed.

SIMPLIFY ITS An Intelligent Tutoring System based on Cognitive Diagnosis Models and spaced learning

Authors: M. Villanueva, Nora; Estévez Costas, Andrés; Fernández Hermida, David; Cañas Rodríguez, Agustín

Organisations: Gradiant

In this paper we introduce Simplify ITS, a novel approach to an adaptive and Intelligent Tutoring System (ITS) aimed to support teachers in enhancing the student knowledge and skills. Unlike other approaches, our proposal does not intend to replace the teachers' role, but rather provides teachers with actionable information to make decisions about how to adapt the learning experience to the student needs. Also, it addresses two of the more important challenges in Learning Analytics solutions: building robust connections to the learning sciences and focusing on the student. In our approach, a student's skill profile is automatically estimated from the student's actions using Cognitive Diagnosis Models. Then, Simplify ITS uses the information contained in student profile to recommend activities during the learning process but also, it provide reviews and practices of those concepts that have been learned previously.

Supporting Competence-based Learning with Visual Learning Analytics and Recommendations

Authors: Villamane, Mikel; Alvarez, Ainhoa; Larranaga, Mikel

Organisations: UPV/EHU, Spain

Currently, competence-based learning is becoming very popular and systems that support this process are needed. Technology enhanced educational systems can notably improve the teaching and learning processes in the context of competence-based learning. In this paper, we present a system called COBLE (Competence-Based Learning Environment) that supports competence-based learning and combines visual learning analytics and recommendation aspects in order to promote the students' and lecturers' self-reflection about the learning and teaching processes.

Sentiment Analysis in MOOCs: A case study

Authors: Moreno-Marcos, Pedro Manuel; Alario-Hoyos, Carlos; Muñoz-Merino, Pedro J.; Estévez-Ayres, Iria; Delgado Kloos, Carlos

Organisations: UNIVERSIDAD CARLOS III DE MADRID, Spain

Forum messages in MOOCs (Massive Open Online Courses) are the most important source of information about the social interactions happening in these courses. Forum messages can be analyzed to detect patterns and learners' behaviors. Particularly, sentiment analysis (e.g., classification in positive and negative messages) can be used as a first step for identifying complex emotions, such as excitement, frustration or boredom. The aim of this work is to compare different machine learning algorithms for sentiment analysis, using a real case study to check how the results can provide information about learners' emotions or patterns in the MOOC. Both supervised and unsupervised (lexicon-based) algorithms were used for the sentiment analysis. The best approaches found were Random Forest and one lexicon based method, which used dictionaries of words. The analysis of the case study also showed an evolution of the positivity over time with the best moment at the beginning of the course and the worst near the deadlines of peerreview assessments.

Exploring the Application of Process Mining to Support Self-Regulated Learning

Authors: Caeiro Rodríguez, Manuel; Llamas Nistal, Martin; Lama Penin, Manuel; Mucientes, Manuel; Mikic Fonte, Fernando A.

Organisations: Universidade de Vigo, Spain; Universidade de Santiago de Compostela, Spain

Self-regulated learning involves students taking the responsibility of their own learning. Self-regulated learning students usually adopt a variety of learning strategies and behaviors, such as the performance of forethoughtperformance-reflection cycles or the regular and sequenced work over time, that eventually enable them to achieve a more significant and long-lasting learning. In this paper, we explore if these particular behaviors and strategies can be analyzed through the application of process mining techniques taking as data the events registered during the performance of learning activities. The discovery of the underlying processes followed by students can open new ways of studying the real self-regulated development of students. The paper reviews the techniques and tools available to perform the process mining of events related to self-regulated learning and describes some initial works in this area. Furthermore, as an initial empirical study, we analyze the process followed by students regarding the visualization of videos provided in a first-year engineering subject. The obtained results are studied taking into account the grades obtained by the students.

Scenarios for the application of learning analytics and the flipped classroom

Authors: Rubio Fernández, Aarón; Muñoz Merino, Pedro José; Delgado Kloos, Carlos

Organisations: Universidad Carlos III de Madrid, Spain

This work aims to define and present some scenarios to use learning analytics with flipped classroom models. We selected some important indicators and visualizations widely used in learning analytics and analyze how to apply them in different types of flipped classroom. Besides, we specify some activities that students and teachers can do in these types of flipped classroom based on the use of learning analytics in order to improve the learning process. We also discuss the advantages of the combination of learning analytics with the flipped classroom, in comparison with only using the flipped classroom.

A Proposal to a Decision Support System Using Learning Analytics

Authors: González Crespo, Rubén; Nieto Acevedo, Yuri Vanessa; Montenegro-Marín, Carlos Enrique; Gaona, Paulo Alonso

Organisations: Universidad Internacional de La Rioja (UNIR), Spain; Corporación Unificada Nacional de Educación Superior CUN; Universidad Distrital Francisco José de Caldas

The latest attention that Learning Analytics has received, in part is because it encounters hidden patterns in educational data that once is processed and integrated into a specific case of use, offers to stakeholders assistance to improve their task into educational context. Due to it highly application, Learning Analytics techniques are integrated into a Decision Support System proposed to help administrators to develop decision making process and collaterally enhance student performance. In this paper, we define a Decision Support System and how it has been use in educational institutions; we present the functionalities of Learning Analytics and present a survey of how can be integrated to produce a Learning Decision Support System to help faculty or departments administrators to improve their decision impact in the academic community.

(SS01B) Gamification of Learning (Gamilearn'18)

Chairs: Mora Carreño, Alberto

Room: 140 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-19 15:00

The inclusion of game experiences in learning processes has been positively shown as a technique to motivate learners. Thus, experiences are introduced in courses by considering game design principles in non-leisure environments like the course structure layout (gamification or gameful design). This topic has garnered great interest in both academia and industry, as reflected by the amount of academic publications in the recent years, especially those showing case studies, hands-on experiences, or business growth of the enterprises specialized in gamification. This Special Session (Gamilearn'18) aims to cover all aspects of gamification including user studies, design frameworks, techniques and strategies, methodologies, tools and applications, ecosystems, analysis and assessment, personalization approaches, systems integrations, data management, architectures, innovations to market, as well as any work in progress. Our main goal is to bring together stakeholders for exchanging ideas and experiences and encouraging networking between academia and industry.

Gamification in MOOCs: A Review of the State of the Art

Authors: Khalil, Mohammad; Wong, Jacqueline; de Koning, Björn; Ebner, Martin; Paas, Fred

Organisations: Delft University of Technology, Netherlands, The; Erasmus University Rotterdam, Netherlands, The; Graz University of Technology, Austria; Erasmus University Rotterdam, Netherlands, The; Early Start Research Institute, University of Wollongong, Australia

A Massive Open Online Course (MOOC) is a type of online learning environment that has the potential to increase students' access to education. However, the low completion rates in MOOCs suggest that student engagement and progression in the courses are problematic. Following the increasing adoption of gamification in education, it is possible that gamification can also be effectively adopted in MOOCs to enhance students' motivation and increase completion rates. Yet at present, the extent to which gamification has been examined in MOOCs is not known. Considering the myriad gamification elements that can be adopted in MOOCs (e.g., leaderboards and digital badges), this theoretical research study reviews scholarly publications examining gamification of MOOCs. The main purpose is to provide an overview of studies on gamification in MOOCs, types of research studies, theories applied, gamification elements implemented, methods of implementation, the overall impact of gamification in MOOCs, and the challenges faced by researchers and practitioners when implementing gamification in MOOCs. The results of the literature study indicate that research on gamification in MOOCs is in its early stages. While there are only a handful of empirical research studies, results of the experiments generally showed a positive relation between gamification and student motivation and engagement. It is concluded that there is a need for further studies using educational theories to account for the effects of employing gamification in MOOCs.

NO-RPG, A Game Interface to Common Core Sequenced Third-Party Educational Games

Authors: Berkling, Kay; Incekara, Mehmet Ali; Wolske, Tom

Organisations: Cooperative State University, Germany

This work is part of a series of publications on enabling education for children without access to schools, teachers and who have little parental guidance.

New estimates by UNESCO reveal that 263 million children and youth are out of school.

At the moment there exist no open source free online schools that do not expect a teacher to accompany the student journey. Without a teacher to help, a game environment can provide motivation, sequencing and content. The platform that we have been working on implements the framework for sorting educational games along the US common core standards. The current publication continues this work by adding the game interface that connects the external content with the child. A prototypical Role Playing Game (RPG) allows children to discover third party educational games leveled by grade and subject. The resulting game can be classified as a MOOC because it is an online course aimed at unlimited participation and open access via the web. The result of this work is the open source code of a game and an installed instance that can be used to connect third party games. The next step is to fill the underlying framework with educational games that hook into the various standards and evaluate the game with children.

Creating Engaging Experiences in MOOCs through In-Course Redeemable Rewards

Authors: Ortega-Arranz, Alejandro; Kalz, Marco; Martínez-Monés, Alejandra

Organisations: GSIC-EMIC Research Group, Universidad de Valladolid, Spain; UN-ESCO Chair of Open Education, Faculty of Management, Science and Technology & Welten Institute, Open University of the Netherlands, Netherlands

Gamification strategies have been proposed to mitigate student disengagement and dropouts in massive online environments, due to the positive results shown by these strategies at lower scales. Among various gamification strategies, redeemable rewards have been identified as an effective element to intrinsically motivate students and increase their engagement in educational settings, including MOOCs. Yet, effective design, implementation and enactment of this gamification strategy in MOOC contexts might face new challenges, given the unique characteristics of these learning settings such as massiveness. As an attempt to help teachers use redeemable rewards in MOOCs, this paper analyzes the characteristics of MOOCs that influence its integration and presents a proposal of a system supporting the design, implementation and enactment of such rewards. The envisioned system is illustrated by a scenario that describes the main features of this system for teachers and students.

Electric Circuit Olympics: games as evaluation tools in engineering

Authors: Calle, Maria; Oliveros, Ingrid; Soto, Jose Daniel; Schettini, Norelli; Ripoll, Lacides

Organisations: Universidad del Norte, Colombia

Electric Circuits courses include topics usually difficult for engineering students, where they must apply their knowledge of mathematics and physics. Additionally, students do not feel motivated to participate in traditional classes, where they have a passive role receiving the information provided by the professor. Consequently, course fail rates may be around 30%or higher. The paper presents one strategy to help students acquire knowledge and improve their performance in the course: evaluation through a competition game named Electric Circuit Olympics. For part of their grade, students compete, both in physical activities and solving problems in electric circuits. Results show that motivation improved, course fail rate decreased to 15% and average final grades increased from 3.4 to 3.7 when comparing a traditional class to the course tested with the Electric Circuit Olympics.

Practical Security Education on Combination of OT and ICT using Gamification Method

Authors: Yonemura, Keiichi; Komura, Ryotaro; Sato, Jun; Matsuoka, Masato

Organisations: National Institute of Technology, Kisarazu College, Japan; National Institute of Technology, Ishikawa College, Japan; National Institute of Technology, Tsuruoka College, Japan; Kaspersky Lab We utilized KIPS (Kaspersky Industrial Protection Simulation) to KOSEN students as a means to learn practical OT security educational contents with gamification. KIPS is the board game is that players have to protect ICT system and OT system from cyber threats. KOSEN is the institution of higher education in Japan which has the unique educational system that students study professional skills and knowledge from fifteen years old. We found the possibility that our students can learn practical OT security and ICT security with KIPS based on which they have already learned basic ICT security skills and knowledge. Furthermore, this learning made our students notice that the importance of practical OT security and it stands on the availability. Moreover, we have to examine more effective educational method by analyzing whether what skills and thoughts influence to learning method with KIPS, and create the way to insert the contents appropriately. We also found that our students have great motivation on playing KIPS and after. From analyzing the scenario and the tendency of action and selection on playing KIPS, we can organize the skills which students can learn in a considerable form. The educational method using KIPS with gamification has extremely high effect. In order for KOSEN students to be strong engineer and keep the pot boiling on industry, it is necessary that we have to examine the educational framework for the next stage.

Gamification technique for teaching programming

Authors: Carreño León, Mónica Adriana; Alvarez Rodriguez, Francisco Javier; Sandoval Bringas, Jesús Andrés; Camacho Gonzalez, Yolanda

Organisations: Universidad Autónoma de Baja California Sur, Mexico; Universidad Autónoma de Aguascalientes, México; Universidad Autónoma de Nayarit, México

This paper presents the application of a gamifi-

cation technique applied to the teaching of programming to students of introductory courses. The experiences were applied to an introductory course in the teaching of programming in Software Development Engineering at the Autonomous University of Baja California Sur (UABCS). They present some theoretical references that support the proposal and a description of the application context is made. Finally, the results of the use and conclusions obtained are presented.

(SS07A) Evaluating Engineering Competencies

Chairs: Queiruga-Dios, Araceli

Room: 60 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-19 15:00

The change in the educational paradigm over the past few years demands a profound revision of the teaching and learning methodology. This new methodology must be applied in the different scenarios that the technological revolution allows, and should reach a consensus in the way the acquisition of competencies is evaluated at different educational levels.

As it is well known, the regulatory framework of the European Higher Education Area has highlighted the need to develop new quality teaching systems, different methodologies, and different educational processes to be used by teams of professors, lecturers and trainers in the universities involved in these changes.

This special session will focus on specific ways to evaluate and assess the acquisition of competencies by engineering students.

Since current lecturers are much more familiar with the content view, it is a major challenge for us to deal with competencies-oriented assessment goals. The collaboration in this session may provide ideas and material for supporting them in this respect. Furthermore, the development of a new approach is being demanded by engineering and science trainers to motivate students, and also for students to be motivated with mathematics learning.

Acquiring Mathematical Competences towards Modelling: Example Using Cluster Analysis

Authors: Gocheva-Ilieva, Snezhana; Kulina, Hristina; Voynikova, Desislava; Ivanov, Atanas; Iliev, Anton; Atanasova, Pavlina

Organisations: University of Plovdiv Paisii Hilendarski, Bulgaria

The further development of a unified approach for competence-based teaching and learning of mathematics is an important step towards creating European standards, including assessment standards. A necessary stage when solving this ambitious problems is the performance of an in-depth analysis of the current state in various European countries. The article considers some issues in this regard, related to the competence of first-year university students in the context of acquiring competences for mathematical modeling of level one. As an example, the topic of data modeling using cluster analysis and software is presented and analyzed. The results of a survey among students are presented.

Analysis of student feedback when using gamification tools in Math subjects

Authors: Hernández Encinas, Ascensión; Santos Sánchez, María Jesús; Bullón Pérez, Juan José; Gayoso Martínez, Víctor

Organisations: University of Salamanca, Spain; Spanish National Research Council (Spain), Spain

As a result of the Bologna Accord and the creation of a European area of higher education, computers and other information technologies have been increasingly used in academic studies with the aim of improving the performance of students. This paper presents the results of a teaching experience using mobile phones and gamification services in engineering degrees as a tool for leveraging the comprehension of mathematical concepts.

Teaching and assessing Discrete Mathematics

Authors: Queiruga-Dios, Araceli; Demlova, Marie; Rodríguez Sánchez, Gerardo; Martín del Rey, Ángel

Organisations: University of Salamanca, Spain; The Czech Technical University in Prague, Czech Republic

In recent the acquisition of mathematical competencies and engineers training in mathematics is a major concern of university teachers. It is well known that mathematics is not a favorite subject of engineering students and students in general sciences. We present and analyze in this paper the specific situation that we have encountered in two different European universities: The University of Salamanca (Spain) and the Czech Technical University in Prague. As in many other universities Discrete Mathematics courses are parts of the engineering bachelor degree curriculum. We will detail both situations, compare the assessment methodology and propose new goals for the future.

Basic mathematics assessment in engineering degrees: case study

Authors: Martín-Vaquero, Jesús; Cáceres, M^a José; Yilmaz, Fatih; Rodríguez, Gerardo; Queiruga Dios, Araceli

Organisations: University of Salamanca (Spain); Gazi Universitesi (Turkey)

With the general objective of highlighting the changes produced in the teaching of mathematics in European engineering studies, this paper presents examples of the University of Salamanca (Spain) and Gazi University (Turkey). The use of technological tools for the teaching and learning of Calculus or Algebra has allowed a change in the objectives and form of content-based teaching such as integral calculus, differential equations or linear algebra, where we have move from training in calculation strategies to reasoning processes for the application of those contents to engineering situations. However, these changes are not always visible in the assessment instruments that are used, therefore, it is considered necessary to go deeper into diverse assessment ways and instruments, that are valid in the different European countries, as proposed in the RULES MATH project.

Integrating of Competences in Mathematics through Software - Case Study

Authors: Kulina, Hristina; Gocheva-Ilieva, Snezhana; Voynikova, Desislava; Atanasova, Pavlina; Ivanov, Atanas; Iliev, Anton

Organisations: University of Plovdiv Paisii Hilendarski, Bulgaria

Providing young people with key competences to help them adapt to the rapidly changing interconnected world is a key part of the European Union's strategies for delivering job growth and sustainable development. The article discusses the issue of developing, expanding and enriching the set of mathematical competences in learners by using specialized mathematical software. It presents the experience of the authors of a particular course in Software Systems in Mathematics in the context of the integration of computer-based and competencebased teaching and learning in mathematics as well as some special assessment methods.

Changing teaching: competencies versus contents

Authors: Dias Rasteiro, Deolinda; Gayoso Martinez, Víctor; Caridade, Cristina; MartinVaquero, Jesús; Queiruga-Dios, Araceli

Organisations: Instituto Superior de Engenharia de Coimbra (Portugal), Portugal; Spanish National Research Council (CSIC), Madrid, Spain; University of Salamanca

Due to the changes created by the Bologna Accord, future engineers must learn not only how to model processes, but also how to analyse events and situations using mathematical tools. Even though problem solving is unanimously considered an important part of their education, sometimes students feel that the problems they are requested to solve are not related to those of the real world, making difficult for them to envision how they will apply their mathematical knowledge in their future working life. As part of a European project proposal, and in order to remove that psychological barrier, we have started to implement a new methodology in our Statistics classes, so students can benefit from a learning model better adapted to their professional needs.

In this contribution, we describe the initial steps of a project whose goal is to teach the subject of Statistics in a more practice way, using real data to enable our students to achieve the competencies set for this matter in an easier way better adapted to the current times.

(SS08A) Innovative Pedagogies in Technology Education – IPTE'18

Chairs: Ktoridou, Despo; Doukanari, Elli

Room: 50 people, theater style, 3 people presidency table, video projector and computer, area mezzanine up of the conference center

Date and time: 2018-04-19 15:00

We live and work in a Technology-centric, economic and social changing world. Organizations are becoming more demanding in requesting additional skills beyond specialization from their employees in order to come up with solutions to complex issues. As today's future graduate technologists are already involved with the demands of this changing Knowledge Age, they need to further develop their knowledge, skills and competencies in order to succeed in their future careers. Unfortunately, these skills are not included in many Higher Technology Education learning outcomes. The question is how can these skills be associated with the educational standards and be effectively integrated in the teaching and learning process. This special session aims to address practices that will help educators and training professionals to equip students with new skills in order to meet the needs of today's demanding workplace.

Case-based Learning: Offering a Premier Targeted Learning Experience for Technology Management Students

Authors: Doukanari, Elli; Ktoridou, Despo; Epaminonda, Epaminondas; Karayiannis, Achilleas

Organisations: University of Nicosia, Cyprus; Kes College

Over the past years, one of the most commonly used student-centered approaches to teaching has been Case-Based Learning (CBL). In particular, CBL is used in engineering, sciences, social sciences, and professional education. This type of learning ensures active participation and leads to innovative solutions to problems. This study investigates the implementation of CBL in the multidisciplinary, undergraduate Management of Innovation and Technology Course (MGT-372) at the University of Nicosia. For the purpose of the study, the data were elicited through student questionnaires, as well as the lecturer's journal observation notes on CBL. The results indicate that CBL can be an effective learning method helping students to develop their analytical, critical thinking and collaboration skills, which help them understand how to manage technology and innovation within an organizational context.

Quality Measures Incorporated in the Re-Engineering of an Undergraduate Computer Science Degree Program

Authors: Domenach, Florent; Savva, Andreas; Stylianou, Vasso; Portides, George

Organisations: Akita International University, Japan; University of Nicosia, Cyprus

This paper reports on the re-engineering process, and its quality control, leading to accreditation of an undergraduate program in Computer Science at the School of Sciences and Engineering of the University of Nicosia. It presents how quantitative assessment tools have been used to re-engineer a Computer Science program, while maintaining a balance between the requests of a Visiting Team of academics that was appointed by the Cyprus Evaluation Committee for Private Universities (the national body supervising private universities), the university officials trying to minimize costs/maximize income in a recessive economic environment, and other constraints imposed by the regulatory framework of the University while maintaining high quality assurance standards.

Business and Management of Games: An Industry Driven Learning Experience for MIS Students

Authors: Christou, Charalambos Stephanou; Doukanari, Elli; Epaminonda, Epaminondas; Ktoridou, Despo; Karayiannis, Achilleas

Organisations: University of Nicosia, Cyprus, Cyprus; Kes College

Industry employers have traditionally been involved with the academia serving in advisory boards and as internship providers. In both cases, their involvement contributes to the development of undergraduate and graduate program curriculums and offering general advice on workforce skills and competencies. This paper describes the collaboration efforts among the Department of Management and MIS of the University of Nicosia, guest lecturers from various disciplines and Game Industry Experts in the creation and implementation of the new industry-driven MIS-465 Business and Management of Games Course. More specifically, the study reports on the design, development and implementation of the course with Game Industry Experts and guest lecturers from other fields playing an active role. Organizational, pedagogical and practical ideas associated with the immersion of students in an industry-driven course are addressed. A suggested framework is presented for educators who want to deliver industry-driven courses.

Recognizing Student Facial Expressions: A Web Application

Authors: Savva, Andreas; Stylianou, Vasso; Kyriacou, Kyriacos; Domenach, Florent

Organisations: University of Nicosia, Cyprus; Basic Education, Akita International University, Akita, Japan

The project described in this paper investigates the idea of performing emotion analysis of a student population participating in active faceto-face classroom instruction. Machine learning algorithms are employed on live recordings collected by webcams that are installed in classrooms. The visualization application required to be remotely accessible by the lecturer so the application was engineered as a web application. The output, being a timeline of student emotions monitored throughout and in parallel with the lecture, serves to enable the lecturer and other interested parties to improve the delivery of education.

Smart Schoolhouse – Designing IoT Study Kits for Project-based Learning in STEM Subjects

Authors: Kusmin, Marge; Saar, Merike; Laanpere, Mart

Organisations: Tallinn University, Estonia

Abstract— STEM (Science, Technology, Engineering and Math) subjects are of critical importance to students but too few students are genuinely interested in them. There is also a common belief that STEM education is complicated and not suitable for girls, which makes it a source of fear. This article introduces STEM education in Estonia, outlines some bottlenecks, and describes the activities we plan to implement in order to raise the awareness of teachers about teaching STEM subjects and to offer students the opportunity to apply their knowledge of different subjects to solve everyday problems through practical activities, integrating IoT opportunities in their learning process. We will present an overview of the project, involving 8 basic schools and 10 upper secondary schools, with nearly 3,100 students involved (from grades 6, 9 and 10-12).

(SS09A) Education, Engineering and Microelectronics

Chairs: Tzanova, Slavka

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-19 15:00

Microelectronics is the most rapidly developing industry sector in the last decades. We need a new partnership between education and work to address the need of synergy between the education and industry, to foster the development of competencies, technological and entrepreneurial skills for the new jobs. This field ranges over a variety of subjects, includes a large number of disciplines dealing with multimedia presentation of the content, simulations, real problems solving and high-order thinking.

On the other hand, there are few individual research teams, laboratories or companies that can reasonably claim to be able to respond to the technological challenges. No one university can afford the necessary infrastructure, clean rooms, technology and experts in all fields of the multidisciplinary micro-/nanoelectronics. The solution is closer cooperation in the university sector and transparency of qualifications and recognition methods.

This Special Session aims to discuss the best practices in microelectronics education, preparation of students for industry, entrepreneurship, as well as collaborative teaching. The Session aims also to exchange good experiences in interuniversity and international collaboration, in sharing resources, laboratories, teachers and students, recognition of curricula.

Development of Two Cycle Innovative Curricula in Microelectronic Engineering

Authors: Tzanova, Slavka

Organisations: Technical University of Sofia, Bulgaria

The paper presents the activities and results of the on-going Erasmus+ Competence Building in Higher Education project DOCMEN in the development and delivery of innovative curricula in microelectronics.

The project started with a survey for need analysis involving 20 partner higher education institutions and many industry stakeholders in Kazakhstan, Armenia and Israel to analyze the situation in the educational programs on micro- nanoelectronics education. The problems concerning curriculum development were identified, as increasing requirements in the training of personnel with a high degree of specialized knowledge and the ability to conduct creative, interdisciplinary curriculum on development and manufacturing of new, hightech electronics. Besides that, the universities don't maintain close ties with the industry for the purpose of pushing forward practical competence of their graduates. To address the problems and challenges identified, nineteen universities and companies from Poland, Germany, Bulgaria, Italy, Armenia, Kazakhstan and Israel share infrastructure, technological

and human resources to develop new curricula, based on the European Credit Transfer System to be used in the corresponding partners' educational programs in micro-nanotechnologies. The project is on the stage of the pilot test of innovated curricula.

Joint International Master in Smart Systems Integration - University Collaboration for Improved Education

Authors: Aasmundtveit, Knut E.; Wang, Changhai; Ender, Ferenc; Desmulliez, Marc P.Y.; Rencz, Marta; Imenes, Kristin

Organisations: University College of Southeast Norway, Norway; Heriot-Watt University, Scotland; Budapest University of Technology and Economics, Hungary

The Joint International Master in Smart Systems Integration (SSI) graduates candidates for the ever-growing industry of Smart Systems, ubiquitous in all sectors of society including healthcare, transport, environment protection, energy and security. SSI is given jointly by three universities in three European countries: Heriot-Watt University (HWU) (Edinburgh, Scotland), University College of Southeast Norway (HSN), and Budapest University of Technology and Economics (BME) (Hungary), utilizing the complementary expertise and laboratory facilities of the three partners to create a unique programme with a more holistic approach than a single university could give. The programme is run in close collaboration with industry, to assure its relevance. SSI has Erasmus Mundus status, and the graduates receive a Joint Degree.

SSI students benefit from the extended competence the consortium can provide, as well as from the extended socio-cultural knowledge obtained by living in three different European countries that represent distinctively different aspects of the diverse Europe. The students in the programme show excellent performance, and the employability of graduates has proven to be very high. The partner universities benefit from the high performance of the students, and from the intimate interaction with the partners allowing exchange of best practice in education, teaching and evaluation.

MECA, the MicroElectronics Cloud Alliance

Authors: Ruo Roch, Massimo; Klossek, Martin; Demarchi, Danilo; Tzanova, Slavka

Organisations: Politecnico di Torino, Italy; eWorks GmbH, Germany; Technical University of Sofia, Bulgary

The MicroElectronics Cloud Alliance (MECA) is a European funded project where 18 higher education institutions, and small and medium enterprises, sited in nine different European countries, have the aim of developing a Cloudbased European infrastructure for improving the education in microelectronics. In MECA open educational resources, educational and professional softwares, remote access to virtual laboratories are shared, all based on modules and learning facilities remotely available.

MECA wants to be the one-stop platform of reference for the microelectronics education and the useful tool for sharing resources among institutes working in microelectronics design training. In fact, thanks to the Cloud system built inside MECA Consortium, the resources of all the partners are shared, both hardware and software, excluding licensing of course, for clear legal reasons.

The targets of MECA are several. The goal is not to conceive the system for students only, but to take the opportunity of developing a common platform in which training institutes can take material, ideas and, the most important aspect, to share the knowledge.

Project target categories and their related actions, derived from the results of a Need Analysis done with industrial partners and academia, can be listed as: (i) Students in microelectronics, with the goal of providing them highquality educational materials and up-to-date courses; (ii) Lecturers, that will take benefit of modern course delivery approaches and of the teaching materials shared inside the MECA Cloud; (iii) University System, exploiting the European vision in higher education given by MECA; (iv) Future Employers of the Students, who will find young specialists more empowered by the new learnt skills, ready for the new jobs in microelectronics design.

Big players like Amazon Web Services (AWS), Microsoft Azure or Google are engaged in the Cloud market. And on the other side there are private Clouds inside of institutes. Also a mixed flavour exists where private Clouds are extended with computing power, additional features like high performance computing and machine learning, or just storage from the public Cloud. This mix can be used for example when there are peak usage requirements during a short period of time – e. g. a summer camp at a university for which it would not be worth to buy several new computers. These layers of virtualization and packaging of computer resources leads automatically to thinking not so much in single computers anymore, but thinking in applications for the end user.

The solutions that can be implemented, listed in an ascending path, are: Infrastructure as a Service (IaaS), where it is implemented a full access to virtual computers; Platform as a Service (PaaS), where the software development layer is fully administrated by the Cloud provider, e. g. a PHP/MySQL web server; Software as a Service (SaaS), where the complete application is fully administrated by the Cloud provider like a WordPress website or a Moodle e-learning installation.

In MECA, all the different levels will be exploited, depending on the application needs. The basic pillar of the infrastructure is the Open Source Solution of Apache Foundation named CloudStack. For MECA purposes CloudStack is the open source Cloud management software that fits the needs and supports all important hypervisors (KVM, VMware,

Hyper–V, XenServer). CloudStack controls the virtual machines with agents or APIs and so can be connected to vendor specific hypervisors, or even extended to satisfy new needs. It works with any client as desktops, notebooks, tablets and its configuration is very transparent because it is stored in a MySQL database, easily accessible for obtaining the needed information, and the management interface is a Java Web Application.

In a first step each university will install its own technical infrastructure, without imemdiately converting the whole existing university equipment to be under control of CloudStack. A step-by-step strategy will be applied, starting from the services that the institute considers more critical using a classical infrastructure, for moving to the rest of the training services in further steps.

Multi-Stakeholder Ecosystems in Rapidly Changing Educational Environments

Authors: Barokas, Jack; Barth, Ingrid

Organisations: Tel Aviv University, Israel

This short paper will describe two cases of educational ecosystems created to help educational institutions best adapt their teaching and learning materials to rapidly changing high school/academia/industry environments. The EduNano National TEMPUS project and the Horizons 2020 Up2University (UP2U) project both represent cases in which collaboration between industry, universities and high schools facilitates rapid response to constantly changing conditions. First, we describe how, in both cases, working together for mutual benefit can enable all stakeholders to adapt more effectively to the challenges of change. We show how similar mutual dependencies and shared interests emerge from different configurations of high-school – university – industry in both projects. Next, we discuss some essential conditions that need to be in place in order for stakeholders to overcome their traditional tendencies to work as isolated entities, instead of as mutually dependent parts of the same ecosystem. Finally, we conclude with some essential prerequisites and 'lessons learned' from both projects to help other educational ecosystems find their way forward and formulate their own rapid-response roadmaps for optimal adaption to changing conditions

(SS10) Multi-Learning: Experiences from the eMadrid Excellence Network

Chairs: Delgado Kloos, Carlos

Room: 50 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-19 15:00

Learning has had many modifiers due to technology, such as e-learning, m-learning, etc. Also, it has tended to be inclusive in the multiple ways. Multimedia, multimodal, multichannel, multi-scale, multi-language, multiinstitution, and for multiple intelligences are ways in which educational technology is applied. In this session of the eMadrid network, we will present how education is embracing technology in multiple ways.

eMadrid <www.emadridnet.org> is the Excellence Network about educational technology funded by the Regional Government of Madrid. Its members are the Universidad Carlos III de Madrid (UC3M), who acts as a coordinator, Universidad Autónoma de Madrid (UAM), Universidad Complutense de Madrid (UCM), Universidad Politécnica de Madrid (UPM), Universidad Rey Juan Carlos (URJC) and Universidad Nacional de Educación a Distancia (UNED). The aim of the network is to provide leadership and perform advanced research in the area of educational technology, including technology transfer to companies. The eMadrid Network has organized special sessions in allprevious EDUCON events. In this year's special session, an overv iew is given about the

research carried out by eMadrid partners that reflects the multiple ways education is embracing technology.

Game Learning Analytics is not informagic!

Authors: Perez-Colado, Ivan; Alonso-Fernandez, Cristina; Freire, Manuel; Martinez-Ortiz, Ivan; Fernandez-Manjon, Baltasar

Organisations: Faculty of Informatics, Complutense University of Madrid, Spain

Game learning analytics has a great potential to provide insight and improve the use of games in different educational situations. However, it is necessary to clearly establish what the requirements are and to set realistic expectations. Application of game learning analytics requires pedagogically informed policies that establish learning goals and relates them to analysis and visualization; and a supporting infrastructure that provides the mechanism on top of which it is executed. Both concerns can be separated: on the one hand, there is a Learning Analytics Model (LAM) which describes how analytics is to be carried out, interpreted as learning, and presented to stakeholders; and on the other hand, an underlying analytics system can concentrate on performance, security, flexibility and generality. An important advantage of this separation is that it allows LAM authors to concentrate on their area of expertise, limiting their exposition to the actual mechanism used underneath. However, LAMs built for a single game fail to account for the frequent case where games and their analytics are aggregated into larger, overarching plots, games or courses. This work describes an extension to an existing game learning analytics system, used in the RAGE and BEACONING H2020 projects, which manages multilevel analytics through improvements to both policy and mechanism; and introduces meta-Learning Analytic Models, which characterize learning in hierarchical structures.

The Hybridization Factor of Technology in Education

Authors: Delgado Kloos, Carlos; Muñoz-Merino, Pedro J.; Alario-Hoyos, Carlos; Estévez-Ayres, Iria; Ibáñez, María Blanca; Crespo-García, Raquel M.

Organisations: Universidad Carlos III de Madrid, Spain

Education has undergone numerous changes over the last few years. The number and variety of technologies that can be used now to access education and enrich teaching and learning scenarios, as well as the number and variety of people that are connected somehow to education entail that we have increasingly complex educational settings. This paper reflects on different aspects of current education and how these relate to multiple factors, which lead to the definition of multieducation. To this end, several terms related to multi-education, such as multi-media, multichannel, multi-scale, multi-modal, and multiintelligence will be analyzed, presenting related works, and trying to find out where we are heading.

LOD-CS2013: Multilearning through a Semantic Representation of Computer Science Curricula

Authors: Piedra, Nelson; Tovar, Edmundo

Organisations: Universidad Técnica Particular de Loja; Universidad Politécnica de Madrid, Spain

In this proposal, the authors present an ontological approach of the essentials necessary for Computer Science Curricula (CS2013), semantic data integration across complementary sub-domains. The ontological definitions (concepts, data properties data and data objects) can be useful to impose and preserve a logical structure for new types of curricula data, which may appear due to autonomous Higher Education Institutions (HEI), protocols and analyses. This semantic representation can be used in multiple modes of learning and to interoperate different curricula of departments of computer science or enable the convergence and interoperability of other disciplines.

An Exploratory Analysis on MOOCs Retention and Certification in Two Courses of Different Knowledge Areas

Authors: Cobos, Ruth; Jurado, Francisco

Organisations: Universidad Autonoma de Madrid, Spain

The massive quantity of learners generating information related to Massive Open Online Courses (MOOCs) make researchers analyze large datasets about the learners' profile, interaction, satisfaction, etc. and these datasets can come from multiple data sources related to the same or different courses. This paper details the conducted exploratory analysis performed with data from two different MOOCs of different knowledge areas to check the factors that influence the learners' retention and certification. The preliminary results we obtained allow us to provide some conclusions with the aim to keep researching in order to generalize our achievements.

Using Text Mining and Linked Open Data to assist the Mashup of Educational Resources

Authors: Vallejo-Figueroa, Santa; Rodriguez-Artacho, Miguel; Castro-Gil, Manuel; San Cristobal, Elio

Organisations: Universidad de Veracruz, Mexico; Universidad Nacional de Educacion a Distancia UNED, Spain

In the process of searching for open educational resources, the use of ontologies is a key aspect in the reusability of resources for instructional purposes. In this paper, we address the issue of automatic tagging and classifying open educational resources by means of text mining techniques. The purpose is to set up a semantic framework in order to be used in the process of authoring educational material. Thus, authoring can be turned from a simple aggregation process into a dynamic and automatic selection of appropriate resources based on instructional needs and learning design.

On Computational Thinking as a Universal Skill

Authors: Moreno León, Jesús; Robles, Gregorio; Román González, Marcos

Organisations: Instituto Nacional de Tecnologías Educativas y Formación del Profesorado, Spain; Universidad Rey Juan Carlos, Spain; Universidad Nacional de Educación a Distancia, Spain

In recent years we are witnessing movements around the world to bring computer programming to schools. Lots of these initiatives, however, have been conceived to address the shortage of professionals in the technology sector, an approach that is encouraged by the software industry. On the contrary, this article argues that the focus should swift towards computational thinking, an ability that goes far beyond computer science or technology, fostering fundamental skills for the citizens of the twentyfirst century. In this paper we summarize the findings of recent investigations that study computational thinking from different perspectives, explaining what this new skill is made of, presenting outcomes of school interventions showing relationships between the development of this ability and improvements in different subjects and soft skills, presenting technologies to foster its development, and reviewing tools that support educators in the assessment of this skill.

(SS11) Applications of Game-Based Learning

Chairs: Utesch, Matthias

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-19 15:00

Young adults in our postmodern society are subject to the effects of media and influences of the internet. Young adults view the access to the internet as a substantial part of their society, and in return they feel "left out" if not involved in the social room "internet". Studies show that a big part of education and learning happens outside of the classroom. Above all, young adults primarily use the Internet for access to knowledge; the online media thus have an educational and political function for the young generation. No wonder that students would rather turn to video games than to learning, as video games create such higher levels of motivation, engagement and satisfaction! Therefore, our educational system is in need to provide more engaging, stimulating scenarios for students in school.

Games offer an 'ice-breaking' introduction to a new topic and inspire interest in the learner. Games also help to establish a dialogue, break social boundaries, and even encourage personal development and improve self-esteem. By the creation of real-world objects or artefacts - like a computer program - the learners not only reflect on their creative experience but also on the active role they take. They organize their own understanding of the topic and become intrinsically motivated to participate further.

Today, electronic games are more than just pastimes – they are platforms through which we experience virtual situations, try out strategies, and develop respectively simulate new ideas. Their wide range of engineering applications include automotive, aerospace and systems engineering, medicine, banking, and management.

Thus, the special session Applications of Game-

Based Learning within the EDUCON 2018 Conference, focuses on discussing theoretical concepts and successful applications that aim at game-based learning and industry oriented game learning in the context of engineering education or further studies in this field.

Simulation Games for the Digital Transformation of Business Processes: Development and Application of Two Prototypes from the Automotive and Online Retail Sector

Authors: Löffler, Alexander; Prifti, Loina; Levkovskyi, Borys; Utesch, Matthias; Krcmar, Helmut

Organisations: Technical University of Munich, Germany; Staatliche Fachober- und Berufsoberschule Technik München, Germany

The goal of this paper is to discuss and evaluate the approach of applying simulation games as a tool for teaching and learning business processes in the context of the digital transformation. For this purpose, we defined learning objectives and based on them, developed two separate simulation games with a different scenario for the digital transformation of business processes. While one game is based on automation in the automotive sector, the other one focuses on the digital transformation in the online retail sector. Both games were applied in class and evaluated afterwards. Thereby, this paper offers concrete examples of simulation games for teaching business processes in the context of the digital transformation and discusses characteristics and scenarios that are important in this context. Furthermore, the paper serves as basis for future research in the area of simulation games and therefore provides a novel contribution to this topic of education.

Teaching Programming Skills in Primary School Mathematics Classes: An Evaluation using Game Programming

Authors: Förster, Emmy-Charlotte; Förster, Klaus-Tycho; Löwe, Thomas

Organisations: Hastily Assembled Games, Germany; University of Vienna, Austria

The integration of programming into the school curriculum has become increasingly important, especially in places and class levels where computer science is not yet available as a subject of its own. In this paper we investigate the performance of a class of sixth grade students who were trained in programming as part of their regular mathematics curriculum following the method of Foerster [ACM SIGITE'16], which uses programming as a teaching tool for geometry skills. As a final project the students were tasked to program a computer game in Scratch, by which we gauge the student's programming skills using the methodology proposed by Funke et al. [IEEE EDUCON'17], as well as the automatic quality assessment tool Dr. Scratch. We compare our results with the results reported by Funke et al. from over 50 students, and with the automatic quality assessment scores of a data set of 250K Scratch programs published by Aivaloglou et al. [MSR'17]. Our pilot study shows that introductory programming skills taught as part of mathematics classes, aiming at the improvement of geometry skills, also satisfy the computer science requirements of an introductory programming course.

Game-Based Learning Efficiency – Study Results of Using the Computerised Board Game "Architectural Jewels of Lublin"

Authors: Milosz, Marek; Montusiewicz, Jerzy

Organisations: Lublin University of Technology, Poland

The game "Architectural Jewels of Lublin" is a

response to the low level of knowledge among school children about the architectural monuments of the city of Lublin, which they are mostly inhabitants of. The article presents the game and the results of a study of the effectiveness of its use in the process of teaching students about the architectural monuments of the city of Lublin. The main objective of the game "Architectural Jewels of Lublin" is interactive game-based learning of history. It was developed as a board game, using modern computer technologies: RFID systems, 3D modeling and printing, and real time programming. The hardware and software used in the game design can help in the process of multi-disciplinary engineer training. This game-based learning efficiency study applied a methodology using the A/B testing technique in conjunction with survey research. The level of knowledge about monuments was assessed on the basis of the survey conducted among pupils using the developed indicator. The survey was filled by various, albeit statistically similar, groups of learners before and after the game. The main result of the study is the finding of an over 31% increase in the level of knowledge among pupils as a result of playing the game "Architectural Jewels of Lublin".

Design of an educational game aimed at teaching SCRUM planning and prioritization

Authors: Gomez, María Clara; Ospina Carvajal, Juan José; Vesga Vesga, Luis Rodrigo

Organisations: Universidad de Medellín, Colombia; Universidad Nacional de Colombia

Scrum is currently one of the most popular agile framework in software industry, it is based on iterative and incremental development of a project. Because of its use in the market, a lot of methods have been developed for teaching Scrum, from detailed guides to educational games. When we talk about Scrum, a critical part is prioritization and planning of each iteration, known as sprints. This is important because a great part of success or failure of a project depend on this topic, but the most popular educational games only focus their attention in the effort estimation, without thinking on the different events that could affect a sprint. In this paper we present the educational game call ScrumTados, which emphasizing the importance of prioritization, planning, and includes possible setbacks that could happen in a software project based in Scrum is designed. Such game reinforces acquired knowledge and improves planning and prioritization skills.

Games as Auxiliary Tool in Teaching of Students within Energy Sector

Authors: Jodłowski, Grzegorz Stefan; Sztekler, Karol; Mirowski, Tomasz

Organisations: AGH University of Science and Technology, Poland; Polish Academy of Sciences, Mineral and Energy Economy Research Institute, Cracow, Poland

The aim of the authors' activities was to introduce new didactic tools and to make classes more attractive for students. The article presents experiences related to the introduction of games on two slightly different objects. A strategy game was used to teach issues related to the energy market, first in its original form and then modified for the needs of the local market. In the second case, it was decided to use a labyrinth-like game to improve knowledge and skills in organic chemistry. Students appreciated such forms of learning, although their game rating is different for both games. The strategy game for the energy market was highly rated by students while the labyrinth was slightly worse.

(SS01C) Gamification of Learning (Gamilearn'18)

Chairs: Mora Carreño, Alberto

Room: 140 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception $\$

Date and time: 2018-04-19 16:30

The inclusion of game experiences in learning processes has been positively shown as a technique to motivate learners. Thus, experiences are introduced in courses by considering game design principles in non-leisure environments like the course structure layout (gamification or gameful design). This topic has garnered great interest in both academia and industry, as reflected by the amount of academic publications in the recent years, especially those showing case studies, hands-on experiences, or business growth of the enterprises specialized in gamification. This Special Session (Gamilearn'18) aims to cover all aspects of gamification including user studies, design frameworks, techniques and strategies, methodologies, tools and applications, ecosystems, analysis and assessment, personalization approaches, systems integrations, data management, architectures, innovations to market, as well as any work in progress. Our main goal is to bring together stakeholders for exchanging ideas and experiences and encouraging networking between academia and industry.

The Use of Digital Games to Teaching Computer Graphics: an Open Opportunity

Authors: Gonzalez, Jose Saul; Moreno, Joan Arnedo; Navarro, Jórdi Sánchez

Organisations: Universidad Autonoma de Cd. Juarez, Mexico; Universitat Oberta de Catalunya, Barcelona, Spain

The use of digital games for learning in the higher education is a current trend that is mainly motivated by their pedagogical attributes if they are designed with specific learning objectives in mind. In the specific case of computer graphics, the intrinsic interactive, visual, and addictive nature of games seems to be a valuable coincidence for learning a discipline which is also highly visual and interactive. In this work, it is presented an overview of the efforts of educators and practitioners to teach computer graphics at the undergraduate level with a special emphasis on the application of digital games as a learning strategy. Authors aim to increase awareness about the detected necessity of diversifying the current offering of digital games in this particular area, which in turn can lead to improvements on how computer graphics is taught in the classroom.

Gamified educational programme for childhood obesity

Authors: Gómez del Río, Nazareth; González González, Carina; Martín González, Raquel; Navarro Adelantado, Vicente; Toledo Delgado, Pedro; Barrios Fleitas, Yeray

Organisations: Universidad de La Laguna, Spain

Physical and active games can attract young people and children to have regular physical exercise and to promote healthy habits. The PROVITAO project has developed a gamified educational program for healthy habits, based on video games assets and motor games. The developed program consists of a plan of activities specifically designed on healthy habits with motor games, commercial video games (WII fit plus and apps) and own such as TANGO:H, that they can be developed at home and in group face-to-face sessions. PROVITAO was applied to a total of 45 children and girls with childhood obesity and their caregivers during the school year, in two phases. The design of the research used It was a mixed type with two control groups (GC) and two experimental groups (GE). The project has created and validated a frame of reference for emotional intervention, monitoring and evaluation, biomedical, interactive, social, psychological and educational, based on games, applied to the treatment of childhood obesity and prevention of complications associated, in addition, with different technological products (exergames, serious games, webapps, sensory libraries, wareable devices, etc.).

Integration of Gamification to Assist Literacy in Children with Special Educational Needs

Authors: Pinedo Rivera, Dafne Ifigenia; Muñoz Arteaga, Jaime; Broisin, Julien; Ponce Gallegos, Julio Cesar

Organisations: Autonomous University of Aguascalientes, Mexico; Université de Toulouse, France

Nowadays, the use of mobile applications is gaining popularity among people, spreading to different areas. Specifically, the use of mobile applications has boomed in the field of education, being increasingly common to find applications in the app stores (PlayStore, AppStore, etc) educational applications that address specific problems such as: reading problems, writing, mathematics and many other topics. Similarly, special education has begun to incorporate the use of mobile applications in the classroom, as parents increasingly allow their children to reinforce knowledge by making use of these applications in their homes. These applications often contain various elements that help the student in their learning process, encouraging and motivating.

In this context, we believe that teaching strategies based on game dynamics can contribute to the development of competences, both specific and transversal, in special education students, at the same time as they can increase students' motivation for learning. These elements are known as gamification techniques. There are a number of gamification techniques that can be incorporated into the learning process of children depending on their needs. The present work exposes the gamification techniques incorporated in a playful way in mobile applications, as well as a methodological proposal for the integration of these techniques in special education environments, carrying out a case study.

Space Chain: A math game for training Geometric and Arithmetic Progressions

Authors: Gomes, Ane Caroline Santos; Rodrigues, Gustavo Soares Mascarenhas; Aboboreira, Brendoon Ryos Rocha; Pessoa Filho, Joaquim

Organisations: Mackenzie Presbyterian University, Brazil

Abstract - This paper presents an educational mobile game: Space Chain. Developed for the iOS platform, the objective of the game is to help teenagers/students to learn in a relaxed and fun way about arithmetic and geometric progression - as it reduces the need for guided study and therefore facilitates students' routine as they have to deal with several subjects at the same time. During the game's creation process and its completion, several studies were conducted through the use of CBL framework as well as its validation as a teaching tool by an evaluation with mathematical specialists. The evaluation consisted in analyzing their experience as users of the game and validating through heuristics the quality of math teaching. Given the result it was possible to understand the target audience, as well as having perception about what can be increased and to prove the efficiency of the tool as a complementary study outside the classrooms.

A Mobile Game to Practice Arithmetic Operations Reasoning

Authors: Cruz, Bruno; Marchesini, Piera; Gatto, Guilherme; Concilio, Ilana

Organisations: Mackenzie Presbyterian University, Brazil

Arithmetic operations are the basis for knowledge of fractions that support the learning of algebra and proficiency in algebra prepare students for higher education and some careers in STEM (Science, Technology, Engineering and Mathematics). This paper presents the proposal and development of a mobile educational game for the iOS platform to stimulate the logical reasoning of Arithmetic Operations, named Puts. In order to stimulate the reasoning of basic operations such as addition, subtraction, multiplication and division, the application consists of a multiplayer card game in which the user, at each round, must perform basic mathematical operations to defeat their opponents. Throughout the process, there was a collaboration with teachers of the graduation course in Mathematics of a Higher Education Institution and, in the end, to validate the usability and instructional design of the game, tests were carried out with five of these specialists.

(SS07B) Evaluating Engineering Competencies

Chairs: Queiruga-Dios, Araceli

Room: 60 people, theater style, 3 people presidency table, video projector and computer, located in the basement at the right of the reception

Date and time: 2018-04-19 16:30

The change in the educational paradigm over the past few years demands a profound revision of the teaching and learning methodology. This new methodology must be applied in the different scenarios that the technological revolution allows, and should reach a consensus in the way the acquisition of competencies is evaluated at different educational levels.

As it is well known, the regulatory framework of the European Higher Education Area has highlighted the need to develop new quality teaching systems, different methodologies, and different educational processes to be used by teams of professors, lecturers and trainers in the universities involved in these changes.

This special session will focus on specific ways to evaluate and assess the acquisition of competencies by engineering students. Since current lecturers are much more familiar with the content view, it is a major challenge for us to deal with competencies-oriented assessment goals. The collaboration in this session may provide ideas and material for supporting them in this respect. Furthermore, the development of a new approach is being demanded by engineering and science trainers to motivate students, and also for students to be motivated with mathematics learning.

Selection and evaluation of mobile mathematical learning applications

Authors: Venter, Marisa Isabel; Swart, Arthur James

Organisations: Central University of Technology, South Africa

The poor performance of learners in math in South Africa is seriously hampering the ability of Higher Education Institutions to provide science, technology, engineering and math graduates. It has been confirmed by various studies that the use of math learning apps offers a wide range of benefits to learners. A current problem with the use of math learning apps is that more than 50% of South African parents reported that they are experiencing trouble searching for and finding appropriate math learning apps for their children. The aim of this paper is twofold. Firstly, guidelines are to be presented of how two online platforms can be used by parents and educators to find appropriate math learning apps for learners. Secondly, the paper reports on how learners evaluated some math learning apps that were recommended by these online platforms. A quantitative research methodology, using a purposive sampling technique, was employed where data was gathered in 2016 from sixty children, aged 8 to 12, from selected schools in one of South Africa's provinces. The results revealed that Balefire Labs and Common Sense Media are the online platforms that provide the most comprehensive rating and evaluation system for math learning apps. Results further indicate that math learning apps that were highly recommended by the two platforms received a statistically significant higher evaluation score from learners. In addition, learners wanted to continue using 82% of the math learning apps that were recommended by the two platforms. The contribution that this study is making towards higher education in engineering is that it is providing teachers and educators with a methodology to use in selecting pedagogically sound and appropriate math learning apps that may better prepare learners for higher education in science, technology, engineering and math education.

Evaluating Engineering Competencies in Curricular Internships

Authors: Lopez-Martin, Antonio; Sanchis, Pablo; Perez-Artieda, Gurutze; Gubia, Eugenio; Astrain, David; Barrenechea, Edurne; Lopez-Taberna, Jesus; Matias, Ignacio R.

Organisations: Public University of Navarre, Spain

A framework for validating key competencies to be acquired during curricular company internships in Engineering degrees is presented. Such competencies are essential in the EHEA initiative but their evaluation is a challenge due to the non-cognitive nature of many of them and the diverse and informal learning environments. The proposed framework has been successfully employed since 2013 at the School of Industrial and Telecommunications Engineering of the Public University of Navarre.

Learning based on 3D photogrammetry models to evaluate the competences in visual testing of welds.

Authors:Rodríguez-Martín,Manuel;Rodríguez-Gonzalvez,Pablo

Organisations: TIDOP Research Group University of Salamanca (Spain), Spain; Catholic University of Avila (Spain); TIDOP Research

Group University of Salamanca (Spain), Spain; University of Leon (Spain)

The present work describes a new learning methodology based on the latest scientific research aimed at the three-dimensional macrophotogrammetric reconstruction of welds, which allows the generation of teaching materials aimed at the acquisition and evaluation of competencies in the non-destructive testing laboratory activities without the need for a physical displacement to the physical installation. This methodology, which can be cataloged within those based on virtual laboratories, is applicable in e-learning courses or can also be used as support material for faceto-face programs, mainly in the bachelor's and master's related to mechanical, naval and aeronautical engineering. The distribution of the packages is easy to load in learning management system in order to work with the models with open software, easily and without the need for additional costs.

University Engineering Education in Saudi Arabia: Evaluation of the Graduates' Competencies

Authors: Albadr, Hamad

Organisations: KSA, Saudi Arabia

A growing shift in focus on quality and output encourages universities to meet the labor market needs by producing highly skilled and well-trained graduates. This paper identifies students' competencies on University led engineering programs in Saudi Arabia. Working towards mastering mathematical skills and exploring their relationship with innovation and design. In this study, 902 people took part from three universities; King Saud, King Abdul Aziz, and King Fahd University of Petroleum and Minerals. Participants were split into four categories: faculty members of administrative and technical bodies, final level students, and graduates from the program. The study dealt with five axes: 1. The program provides students with knowledge, theories and engineering

principles related to their profession, 2. The program helps students to be aware of scientific and technical developments in their field of profession, 3. Students use logical and logical reasoning to solve the engineering problems they face, 4. Students can use appropriate mathematical and computer techniques in analysis and reasoning. 5. Students can design, implement and evaluate engineering projects. The research found the presence of semantics and statistical differences between students' competences in Saudi Arabian universities. They showed a strong link between mathematical skills and an increased ability to design and undertake engineering projects. The research found students were well equipped with the knowledge, theories and principles they needed in relation to their competences. And enabled them to use these methods of reasoning and logical thinking to solve engineering problems. They demonstrated the ability to innovate and push boundaries in design and product imple-The research recommended the mentation. necessity to provide students with the knowledge and theories of engineering principles to increase their competences. Teaching them using deductive reasoning and logical thinking to solve engineering problems. Focusing on increasing their ability to use the appropriate mathematical and computational methods in their analysis. Thus, it will allow Saudi Arabian universities to identify and develop talented individuals in their field and stay at the cutting edge of the engineering design industry.

A Six-Sigma Approach to Improve the Acquisition of Engineering Competencies

Authors: Al-Bahi, Ali M.; Soliman, Abdelfattah Y.

Organisations: King Abdulaziz University, Saudi Arabia

An assessment and evaluation strategy of the acquisition of engineering competencies that is based on the six sigma approach is presented. The main objective is to decrease the chance of having a passing student who failed to attain a specific competency identified by the program as a required outcome of the engineering curriculum. These competencies are identified by the profession as important for the correct performance of the job of engineers and for the fulfillment of their role in the society. The proposed process is expected to help the students to improve their attainment of engineering competencies in successive courses while minimizing the faculty workload associated with assessing and evaluating the attainment of these outcomes.

Learning Analytics and Evaluative Mentoring to increase the students' performance in Computer Science

Authors: Ruiz-Ferrández, Miriam; Ortega, Gloria; Roca, Javier

Organisations: University of Almería, Spain

This work is devoted to presenting some strategies aimed at incrementing the students' commitment with their formative process and, at the same time, achieving a satisfactory evaluative procedure. The strategies described in this work have been applied in the subject "Computer Structure and Technology", which corresponds to the BSc in Computer Science syllabus at the University of Almería. Broadly speaking, the subject delves into internal aspects of computer operation, such as several devices found in the computer data path, memory organization, and the control unit. These issues are frequently very unpopular among students because they are not familiar with the deepest level of the operations and, therefore, they usually need to dedicate a huge amount of time and effort to understand them. For these reasons, a student's level of competency at the endo of the course is not usually very high and many students even drop out of the subject in its early stages. To overcome this situation, we have introduced two novelties in the learning methodology. On the one hand, we

have taken advantage of possibilities that the Learning Management System of our university (Blackboard) offers using Learning Analytics to find out what activities are more relevant from an academic result point of view. On the other hand, we have proposed evaluative mentoring to personally deal with the students' necessities. Thus, the methodology combines the advantages of both, online and on-site activities. As an obtained result, we have studied the validity of the methodological strategies, detecting the issues that have more impact on the assessment results. This fact is very helpful to focus our attention on these issues in the following academic years. Moreover, we have demonstrated a significative improvement in students' competency levels with respect to previous academic years in the same subject and other subjects of the same course.

(SS08B) Innovative Pedagogies in Technology Education – IPTE'18

Chairs: Ktoridou, Despo; Doukanari, Elli

Room: 50 people, theater style, 3 people presidency table, video projector and computer, area mezzanine up of the conference center

Date and time: 2018-04-19 16:30

We live and work in a Technology-centric, economic and social changing world. Organizations are becoming more demanding in requesting additional skills beyond specialization from their employees in order to come up with solutions to complex issues. As today's future graduate technologists are already involved with the demands of this changing Knowledge Age, they need to further develop their knowledge, skills and competencies in order to succeed in their future careers. Unfortunately, these skills are not included in many Higher Technology Education learning outcomes. The question is how can these skills be associated with the educational standards and be effectively integrated in the teaching and learning process. This special session aims to address practices that will

help educators and training professionals to equip students with new skills in order to meet the needs of today's demanding workplace.

Patent documents in STEM and PhD education

Authors: Reymond, David; Quoniam, Luc

Organisations: Université de Toulon, France

Patents are an unused informational source in research and education. We state that patent documents are an information source opening a wide variety of usage (monitoring, strategic positioning, technical document for innovation and state of the art) for a wide variety of users (researchers, Small and medium Enterprises (SME) and start-ups) a key resource in education but difficult to read.

The European Patent Database (EspaceNet) offers 100 millions of demands viewed as a technological encyclopedia, for most of its content free of rights. As-it, Patent2Net, a free opensource patent analysis tool offer the potential to extract patents from the worldwide database and to explore huge sets of patents documents using several data mining tools and visualization techniques (dynamic networks, textometry application, classification). Scenarios of analysis are provided here to consider patent documents as a technical resource. We show some instances for using these to several key informational objectives for technical education: to provide cartographies of a technology using mindmaps, to decompose an invention, to map the network of actors, and many other features directly in concern with innovation, knowledge, and education.

Use of Remote Laboratories in the Teaching of Technological Degree

Authors: Baez Ramos, Heyson; Espejo Mojica, Oscar Gabriel

Organisations: Corporación Minuto de Dios, Colombia This paper presents the proposal, design, methodology and implementation processes of Remote Labs for the development of courses in Professional, Technological and Technical degrees in the fields of Electronics engineering and its related topics. These Remote Labs aim to solve some of the current problems of the students regarding their mobility, accessibility and learning processes. This research project is based on preliminary works as referenced in [1] and its main goal is to improve the former models documented in those theses, so they can be used functionally in an educational environment that addresses subjects like instrumentation, digital circuits theory and analog circuits theory in the Technology in Electronics program held in the UNIMINUTO University in Colombia. This paper includes a brief foreword where the main subjects and the related documents reviewed are presented, then describes the methodology applied in the development of the Remote Labs, along with the virtualization processes and applications in the selected subjects, to finish with an exposition of the preliminary results, the upcoming tasks and the conclusions of this phase of the research project.

Promoting Innovation and Entrepreneurship skills in Professionals in Software Engineering Training: An approach to the Academy and Bodies of Knowledge context.

Authors: Quezada-Sarmiento, Pablo Alejandro; Mengual Andres, Santiago; Enciso, Liliana; Mayorga Díaz, Monica Patricia; Hernandez Perdomo, Wilmar; Vivanco Ochoa, Johanna Vanessa; Torres- Carrion, Pablo Vicente

Organisations: Universidad Internacional del Ecuador; Universitat de ValEncia; Universidad Tecnica Particular de Loja, Ecuador; Universidad Regional Autónoma de Los Andes UNIANDES, Facultad de Sistemas Mercantiles; Universidad de las Americas

Bodies of Knowledge (BOK) contain the most

relevant knowledge for a discipline. BOK must embody the consensus reached by the community for which a specific BOK will be applied. This consensus is a prerequisite for the adoption of the BOK by the community. In this context, at the level of higher education, especially in the field of software engineering, the academic world shows a significant enthusiasm for the development of various competencies related to entrepreneurship and innovation, focusing on both the promotion of opportunities and the strengthening of existing connections between university and software industry. The reality is that one of the main challenges in software engineering is to find the correct entrepreneurship competencies that should be promoted when training professionals, once the latter have finished their studies and started working in either the national or international software industry. In this sense, this paper is aimed at generating innovation and entrepreneurship skills in professionals in software engineering training. These competences are based on BOK principles.

Empowering Social Innovators through Collaborative and Experiential Learning

Authors: Pappas, Ilias; Mora, Simone; Jaccheri, Letizia; Mikalef, Patrick

Organisations: Norwegian University of Science and Technology (NTNU), Norway

Educating social innovators in higher education is of great importance as many societal challenges exist. This study combines experiential learning with collaborative learning to provide students with the needed competences and experiences to solve societal challenges. We employ this approach in an innovative course, named Experts in Teamwork (EiT), which follows the experiential learning cycle. The participants of this study are undergraduate students interested to learn how they can solve societal challenges. Specifically, 26 students with various background and nationalities participated. A collaborative platform was developed that supports teamwork and cooperation, as well as the social innovation process. The findings show that this approach can influence positively learning outcomes and increase students' engagement and motivation with both social innovation and the learning process. Also, students' creativity was increased leading to the development of better solutions. The overall outcomes contribute to theoretical and practical development, to allow educators to take appropriate measures to enhance students' learning experience and foster social innovation through contemporary learning technologies.

Shared curriculum at KTH and UPC universities: Blended learning experience at the Msc SELECT programme

Authors: Valderrama, César; Hagström, Peter; Nordgreen, Thomas

Organisations: Universitat Politècnica de Catalunya · Barcelona Tech, Spain; Royal Institute of Technology (KTH)

The paper focuses on the experience and lessons learned of experimental implementing of blended learning methodology in the The Master programme "Environomical Pathways for Sustainable Energy Systems" (SELECT) at the Royal Institute of Technology (KTH in Stockholm) and the Universitat Politècnica de Catalunya · BarcelonaTech (UPC in Barcelona), in common and remotely taught courses (shared curriculum) under a transnational framework. Shared curriculum has been designed and strongly connected to the intended learning outcomes (ILO's) of the programme. The aim of blended learning application is to improve the efficiency of the learning process by means of up-to-date highlytechnological means of instruction and to have the same curriculum with equally shared teaching load to ensure that students by the end of year 1 have the same competence and background. It can be noted that, at least from the perspective of academic performance, the implementation of blended learning in the shared SELECT curriculum does not have a significant impact, although local students show slightly higher grade point average (GPA). Finally, and from our general experience with students, it is possible to identify the interaction of communication as one of the key challenges and factors in blended education.

(SS09B) Education, Engineering and Microelectronics

Chairs: Tzanova, Slavka

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-19 16:30

Microelectronics is the most rapidly developing industry sector in the last decades. We need a new partnership between education and work to address the need of synergy between the education and industry, to foster the development of competencies, technological and entrepreneurial skills for the new jobs. This field ranges over a variety of subjects, includes a large number of disciplines dealing with multimedia presentation of the content, simulations, real problems solving and high-order thinking.

On the other hand, there are few individual research teams, laboratories or companies that can reasonably claim to be able to respond to the technological challenges. No one university can afford the necessary infrastructure, clean rooms, technology and experts in all fields of the multidisciplinary micro-/nanoelectronics. The solution is closer cooperation in the university sector and transparency of qualifications and recognition methods.

This Special Session aims to discuss the best practices in microelectronics education, preparation of students for industry, entrepreneurship, as well as collaborative teaching. The Session aims also to exchange good experiences in interuniversity and international collaboration, in sharing resources, laboratories, teachers and students, recognition of curricula.

Initiating Pilot Research About Enhanced Physics 1 for Electrical and Electronic Engineering Students

Authors: Sabag, Nissim; Pundak, David; Trotskovsky, Elena

Organisations: ORT Braude College, Israel; ORT Braude College, Israel & Kinneret College, Israel

I. INTRODUCTION

Difficulties in studying the enhanced physics courses with the EEE (Electrical and Electronic Engineering) students are a worldwide problem. The same situation is in a prestigious college of engineering in the north of Israel over the last 25 years. The EEE students are required to study the enhanced physics 1 (mechanics), enhanced physics 2 (electricity and magnetism) and enhance physics 3 (modern physics). The EEE students' grades in physics courses are dramatically lower than in other courses even comparable to very complicated courses like Random Signals and Noise, or Electrical Fields. For example, the average grade on the final exam of the last semester (second semester 2017) is 34 (out of 100). Our previous research (conducted in 2014-2015) revealed that students that succeeded the Enhanced Physics 1 spent more than 40% of their study time to reinforce theoretical issues and read the questions of the exam at least twice. It also revealed that all students claim that their mathematics knowledge is not strong. Nevertheless, the EEE students' achievements in physics (especially Enhanced Physics 1) are disappointing. Therefore, the authors of the current paper continue to find efficient methods to improve the students' achievements and reduce the number of failing students. We believe the current research, in which physicians and EEE lecturers are working together to find efficient methods to cope with a worldwide difficulty (improving

the students' achievements in physics) deserve to report at an international conference.

Enhancing the Teaching Effect of ESP for Engineering Students with Interactive Tools Based on WeChat

Authors: Gu, Haiyun; Ren, Lei

Organisations: Department of Electronic Engineering, Shanghai Maritime University, China

As a prerequisite for EMI (English as Medium of Instruction) specialized courses, ESP (English for Specific Purposes) is supposed to help the engineering students learn the academic vocabulary and terms, discuss the related topics, and improve their research skills. Besides, comparing to the EMI specialized courses in which the teachers usually have pressure to cover a lot of academic contents, ESP might be the most suitable course for Chinese engineering students to improve the interacting and presenting skills in English. Nowadays, WeChat is the most popular social app in China. WeChat public platform provides an efficient way to share and spread information. In order to enhance the teaching effect and the student engagement, two WeChat-based interactive tools, Rain classroom and Formtalk, were adopted in the ESP classroom for 40 electronic engineering students. The students' feedbacks were also collected by the interactive tools before, during and after the lectures. The purpose of this paper is to describe the methods and share the experiences.

Teachers' Perceptions of Professional Development in Integrated STEM Education in Primary Schools

Authors: Zheng, Shudan; Wong, Gary K. W.

Organisations: The University of Hong Kong, Hong Kong S.A.R. (China)

Abstract—The promotion of STEM (Science, Technology, Engineering, Mathematics) educa-

tion aims to provide students with chances of solving real-world problems based on their disciplinary knowledge and skills. One teaching approach in STEM is through integration, which may enable students to understand the interconnection among disciplines and formulate a solution with consideration of multiple disciples. To implement STEM education in primary schools, an attention has been paid to teachers' professional development (PD), and one particular interest is to develop an effective way to elevate the teachers' knowledge in engineering to become capable in teaching in the integrated approach. In order to guide policymakers to design an effective PD workshop/course, our work aims to first gain an understanding of teachers' expectations toward the PD and then develop a conceptual PD model for integrated STEM. This paper conducts a qualitative case study to deeper analyze primary school teachers' perception of PD and STEM education, as well as their potential challenges. The data came from the individual interview with eight in-service primary teachers (n = 8), the result shows that teachers' challenges in attending PD lie in the intrinsic challenge of a lack of knowledge in 1). how to apply knowledge learned into practical teaching, 2). differentiation of needs and skills, and 3). their values while extrinsic challenges are reflected in aspects of 4). a lack of support, 5). vague school decision and 6). a lack of guidance of direction. Regarding their expectation of STEM PD, suggestions could be made on a focus of content & pedagogical knowledge of STEM subjects, practical activities and contextualisation.

Educational Platform for Reliability Assessment of Power Quality

Authors: Moreno-Garcia, Isabel; Gil-de-Castro, Aurora; Moreno-Munoz, Antonio; Pallares-Lopez, Victor; Medina-Gracia, Ricardo; Matabuena, David

Organisations: Universidad de Cordoba, Spain Power quality (PQ) has been increasing interest in recent years due to the high integration of sources of distributed generation (DG) in the electricity market. This interest has contributed to the fact that there is now a considerable amount of research into early detection of faults and their in processes in operation. This paper presents the design and implementation of an educational platform based on embedded electronic systems to operate in real time in DG framework. We contend that the causal relationship between building model solutions and developing products from these solutions provides a sound basis for industrial strength software engineering. The test bench proposed enables both undergraduate and graduate electrical and electronics engineering students to analyze the modelling techniques developed for event analysis. The architecture has been specially configured to assess the efficiency of algorithms when they are executed in real time. A case study, as well as the experimental results, are presented, which show and address the performance of the educational platform.

(SS12) Internet of Things Education (IoT-Edu)

Chairs: Assante, Dario

Room: 50 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-19 16:30

Internet of Things (IoT) is widely considered as the next step towards of the digital society, where objects and people are interconnected and interact through communication networks. IoT not only has a huge social impact, but can also support the employability and boost the competitiveness of companies. It is widely considered as one of the most important key drivers for the implementation of the so-called Industry 4.0 and for the digital transformation of the companies. Relevant impact of this technology is expected in a wide range of sectors. The rapid diffusion of IoT technologies has created an important educational challenge, namely the need to train a large number of professionals able to design and manage IoT based devices, networks and systems for a large number of different sectors.

The special session "Internet of Things Education" within the EDUCON 2018 Conference focuses on all the educational activities related to IoT, including academic and VET programs, work-based education, virtual and remote labs for didactic porpoises, national and international educational policies and instruments, international projects.

A novel platform for the experimental training on Internet of Energy

Authors: Capasso, Clemente; Veneri, Ottorino; Assante, Dario

Organisations: Consiglio Nazionale delle Ricerche - Istituto Motori, Italy; Università Telematica Internazionale UNINET-TUNO, Italy

This paper deals with the use of laboratory test benches as a novel platform for educational purposes. In this regard, some laboratory facilities of National Research Council of Italy - Istituto Motori (in Naples) are analyzed as case study of an experimental learning platform for engineers and operators in the field of Internet of Energy (IoE). In particular, these facilities are devoted to study the main components of a smart grid, with particular attention on electric power-trains, energy storage systems, renewable energy sources and fast charging architectures for electric vehicles. The laboratory tools can be locally and remotely controlled by each learner, involved in training courses based on this platform, through acquisition and control devices, which can be managed by means of programmable software interfaces. In this way, the proposed learning platform represents a novel educational instrument to train new professional profiles, with particular skills on

ICT technologies, software programming and hardware management for IoE applications.

Internet of Things education: labor market training needs and national policies

Authors: Assante, Dario; Romano, Elpidio; Flamini, Marta; Martin, Sergio; Castro, Manuel; Lavirotte, Stephane; Rey, Gaetan; Leisenberg, Manfred; Migliori, Marco Oreste; Bagdoniene, Irma; Tavio Gallo, Ricardo; Pascoal, Alcino; Spatafora, Mario

Organisations: Università Telematica Internazionale UNINETTUNO, Italy; UNED -Spanish University for Distance Education, Italy; Université Nice-Sophia Antipolis, France; Fachhochschule des Mittelstands, Germany; Cedel Cooperativa Sociale ELIS, Italy; Kaunas Science and Technology Park, Lithuania; EVM Ecosistemas Virtuales y Modulares, Spain; Madan Parque, Portugal; Associazione Effebi, Italy

Small and medium sized enterprises (SMEs) are a pillar of European economy. Nowadays the acquisition of new e-competences is essential to follow the digital transformation for the society and the market, and to keep an adequate level of competitiveness. Internet of Things (IoT) are producing a relevant impact in several economic sectors (industry, transportations, energy, agriculture, home automation, etc.). This technology has a high potential in terms of new business opportunities and new job positions. Several national and European policies have been set-up to train the EU companies to the adoption and diffusion of the IoT technologies. This is also the main aim of the European project IoT4SMEs. In this paper, we describe the early activity of the project, focused on an assessment of the labour market training needs related to the IoT technologies.

Teaching cloud computing using Web of Things devices

Authors: Pastor Vargas, Rafael; Romero Hortelano, Miguel; Tobarra Abad, Llanos; Cano Carrillo, Jesus; Hernandez Berlinches, Roberto

Organisations: Department of Communication and Control System, UNED, Madrid, Spain; San Pablo CEU University, Madrid, Spain

This work deals with the teaching of the innovative technology, named cloud computing, using the Web of Things (WoT) platform model based on web services. These services are designed and programmed by the students to handle embedded hardware devices (things) on Internet. The course is carried out within a makerspace where our students can take advantage of valuable on-line tools which are available in a collaborative learning environment. The introduction of these innovative technological elements improves the students' interest and engagement leading to achieve better learning results

IoE-a solution for improving the efficiency of reversible energy

Authors: Doost Mohammadian, Hamid

Organisations: University of Applied Sciences (FHM), Germany

Increasing consumption of energy and numerous extraction obstacles which most of countries worldwide currently are facing, caused researchers and consumers in different era including commercial, industrial and household domain to seek for new and optimum solutions to increase productivity and decrease destructive effects of consumption. These obstacles include: completion of fossil fuels and tendency to renewable energy, environmental changes, tendency to network information systems, rising of the energy costs and technologies development. The ultimate goal of the most efforts and researches is to decrease energy consumption and increase consumers' welfare in all areas. Internet of energy (IoE) technology as one of the latest method in the world has created intelligent environment by equipping different environment with advanced sensors. These technologies provide intelligent connection between users, providers and suppliers with energy consumption environment and monitoring systems which consequently leads to efficiency in energy consumption. Beside, users' behaviors and their consumption behavior patterns can be predicted and then be modified using enablers of this technology which is based on sensors. The results of this paper demonstrate that IoE technology is capable to recognize temperature, light, sound, heat and proper humidity in environment, manage energy in smart environment, decrease CO2 gas, and prevent from environmental damages.

Industry-University Collaboration on IoT Cyber Security Education: Academic Course: "Resilience of Internet of Things and Cyber-Physical Systems"

Authors: Rajamäki, Jyri

Organisations: Laurea University of Applied sciences, Finland

Internet of Things (IoT) and Cyber-Physical Systems (CPS) are an expansive heterogeneous field, where technologies are replaced faster than the engineering staff. As a consequence, traditions for education and graduation of engineers of IoT and CPS are not yet established. Cybersecurity is essential for new innovations, economic growth and public safety. On the other hand, Center for Cyber Safety and Education estimates that by 2022 there is a deficit of 350 000 cybersecurity specialists in the private sector in Europe. This paper has two contributions: First, it presents an example how an industry-university collaboration on IoT cyber security education could be organized. Then, the data be produced during the collaboration course is analyzed and

compared to literature for answering to the main research question: How can future educational competences with regard to resilient cyber-physical systems be understood? Due to the multifaceted nature of the cybersecurity, previous development of degree programmes tend to synthesize either technical or societal subjects. Real multi-disciplinary synthesis has remained complicated. Our main conclusion is that future competences with regard to CPS are multidisciplinary including many industrial sectors and academic disciplines as well as multiple theories. On the other hand, traditional security thinking is not possible within new heavily interconnected systems of systems, and we should move towards resilience thinking.

OERs for improving European SMEs competitiveness: from video-lectures to remote labs

Authors: Martin, Sergio; Assante, Dario; Castro, Manuel

Organisations: UNED - Spanish University for Distance Education, Spain; International Telematic University Uninettuno, UTIU

This article describes the different Open Educational Resources included in several Vocational Education and Training qualifications designed by the authors. The aim of these courses is to foster European SMEs competitiveness through new technologies such as Cloud Computing, Internet of Things and Internet of Energy. The main resources included in the didactic courses designed are video lectures, interviews, showcases, webinars and demonstrators.

(SS13) Technical Didactics Software Engineering (TDSE)

Chairs: Mottok, Juergen

Room: 30 people, theater style, 3 people presidency table, video projector and computer, located in the first floor at the right

Date and time: 2018-04-19 16:30

This Special Session (TDSE) within the IEEE EDUCON 2018 Conference aims for the seventh time to foster the discussion on "Experiences in Learning and Teaching Software Engineering" by providing a forum for experiments and experiences and the lessons learned in line with the mission of the Workgroup Technical Didactics Software Engineering.

The mission of the workgroup Technical Didactics Software Engineering is:

• Goal oriented Learning and Teaching Software Engineering

• Evaluating new teaching concepts for Software Engineering

• Transfer of our findings and insights in a better teaching and learning of Software Engineering

Algorithmically Supported Team Composition for Software Engineering Project Courses

Authors: Dzvonyar, Dora; Henze, Dominic; Alperowitz, Lukas; Bruegge, Bernd

Organisations: Technical University of Munich, Germany

Composing project teams of students for software engineering courses is a challenging problem for instructors: they need to take into account objectives and constraints such as project motivation, balance of experience in the teams, team size and cultural criteria. In this paper, we present TEASE, a system that algorithmically supports instructors in creating project teams. TEASE proposes possible assignments and enables the instructor to manually adapt them based on their experience. The system also visualizes the effects of these changes on the previously defined objectives and constraints.

Our evaluation in a multi-project capstone course shows that TEASE helps instructors cre-

ate teams with better mean project priority while enabling them to satisfy constraints that were broken during manual assignment. Moreover, TEASE reduced the time needed for team composition by over 60%, making especially the beginning of large project courses more manageable for instructors.

Yes We CAN: A Low-Cost Approach To Simulate Real-World Automotive Platforms In Systems Engineering Education for Non-Computer Science Majors

Authors: Meyer, Dany; Bergande, Bianca; Seyser, Dominik

Organisations: University of Applied Sciences Neu-Ulm, Germany

In system engineering education, physical computing and problem-based learning are used successfully for some time. These concepts are especially suitable for programming novices and computer science non-major students. However, their broad adoption in universities requires access to affordable low-cost hardware. But for courses specific to the automotive domain, usually specific and expensive hardware and toolchains are required. Therefore, in this paper an approach is presented simulating realworld embedded systems by low-cost singleboard computer hardware and allowing the students to focus on the essential elements of the system design. A customized teaching scenario including a laboratory vehicle based on lowcost hardware enables practical lessons in the area of "Connected Car Applications" (Car2x). The evaluation results demonstrate the practical feasibility and its strong acceptance and positive influence on the learning success.

Improving the Experience of Teaching Scrum

Authors: Perez-Castillo, Ricardo; Caballero, Ismael; Rodríguez, Moisés **Organisations:** Institute of Technology and Information Systems, University of Castilla-La Mancha; Institute of Technology and Information Systems, University of Castilla-La Mancha; AQCLab Software and Data Quality Laboratory

Scrum dramatically shortens the feedback loop between customer and developers as well as between requirement list and functional implementations. Scrum poses to turn small teams into self-managers of their own work. Despite the increasing importance of Scrum in the software development Industry, Academia is not providing a suitable response to meet the demand of professionals. This is because, in many cases, reference curricula do not consider Scrum with a great relevance in knowledge areas nor in time scheduled for it. Even so, Academia should be able to educate and provide software engineers with enough Scrum knowledge and skills. To collaborate to this aim, we present our efforts for improving the teaching/learning experience when dealing with time limitations: we have verified that when using a comparison strategy (regarding traditional software development methodologies like Unified Process, (UP)), students improve their learning process. To validate our results, students were assessed through a twofold assessment: (i) based on Scrum certification exams plus, and with (ii) a questionnaire based on the previously mentioned comparison (Scrum vs UP). The main conclusion raised from this investigation is that students' learning experience is really more satisfactory when Scrum concepts are introduced after a comparison with UP ones.

Teaching Agile Principles and Software Engineering Concepts through Real-Life Projects

Authors: Heberle, Andreas; Neumann, Rainer; Stengel, Ingo; Regier, Stefanie

Organisations: University of Applied Sciences Karlsruhe, Germany

Today employees in IT related areas are expected to know the newest technologies and to be able to apply it independently in their projects. This requires a deeper understanding and additional competences that are not taught in lectures or addressed by Project Based Learning (PBL) approaches. In this paper, an approach to teach software engineering concepts using the Scrum framework in real life projects is presented. It extends the PBL concept with respect to competences. Feedback from students, customers as well as our own experience confirm the benefits of the presented approach.

Karel relearns C - Teaching good software engineering practices in CS1 with Karel the Robot

Authors: Heckner, Markus; Scherzinger, Stefanie; Bazo, Alexander; Wolff, Christian

Organisations: Technical University of Applied Sciences Regensburg, Germany; University of Regensburg, Germany

This paper describes our implementation, teaching philosophy, and experiences with our own C-version of the widely known Karel the Robot graphical introductory programming micro-language. Karel enables students to programmatically solve problems, using the C language, in a two-dimensional world by moving the robot around while checking and manipulating its surroundings. We use Karel to solve the dilemma of either demanding too much or not enough from students during the first weeks of an introductory CS course, since interesting problems can be solved with limited input from lectures. Karel enables problem solving from day one of CS1, and encourages good software engineering practices such as top-down design from the beginning. We outline typical problems in the first weeks of CS1.

We present a short overview of existing Karel implementations various programming languages and our rationale for reimplementing Karel. We demonstrate how Karel is being used from a student perspective, along with a typical programming task. We outline how we use Karel in the classroom and discuss preliminary results of a survey and interviews with students from a first course in which Karel was used.

Authors

- Aasmundtveit, Knut E. University College of Southeast Norway, Norway
- Abad Espinoza, Marco Patricio Universidad Técnica Particular de Loja, Ecuador
- Abdullah, Abdul Halim Universiti Teknologi Malaysia, Malaysia
- Abeyweera, Ruchira Rohanajith The Open University of Sri Lanka (OUSL), Sri Lanka
- Abke, Jörg University of Applied Sciences Aschaffenburg, Germany
- Aboboreira, Brendoon Ryos Rocha Mackenzie Presbyterian University, Brazil
- Absi, Rafik EBI, France
- AbuShanab, Shatha Bonn-Rhein-Sieg University of Applied Science, Germany; Siegen University, Germany
- Aceto, Stefania Universidad Internacional de la Rioja, Spain
- Aciar, Silvana Universidad Nacional de San Juan, Argentina
- Acurio Maldonado, Santiago Pontificia Universidad Católica del Ecuador Sede Ambato, Escuela de Ingenieria de Sistemas
- Adorjan, Alejandro Universidad ORT Uruguay, Uruguay

- Afonso, Herlander Costa Alegre da Gama CEFET/RJ, Brazil
- Afrose, Sharmin Bangladesh University of Engineering and Technology, Dhaka, Bangladesh.
- Aguayo, Stteffano Polytechic School of Chimborazo, Ecuador
- Ahuett, Horacio Tecnologico de Monterrey, Mexico
- Ahuett-Garza, Horacio Tecnologico de Monterrey México
- Ajanovski, Vangel V. Ss. Cyril and Methodius University in Skopje, Macedonia, Macedonia, Former Yugoslav Republic of
- Ajhoun, Rachida National high school of Computer science and System Analysis (ENSIAS), Morocco
- Akharraz, Laila IRF-SIC Laboratory IBN ZOHR University B.P.28 / S - Agadir - Morocco
- Al Jassmi, Hamad UAE University, United Arab Emirates
- Al-Bahi, Ali M. King Abdulaziz University, Saudi Arabia
- Al-Hammadi, Yousof Khalifa University, United Arab Emirates
- Alario-Hoyos, Carlos UNIVERSIDAD CARLOS III DE MADRID, Spain
- Alayón, Silvia University of La Laguna, Spain
- Albadr, Hamad KSA, Saudi Arabia

- Alban, Mayra Technical University of Cotopaxi; State University of San Marcos
- Alblawi, Adel Shaqra University, Saudi Arabia
- Aldea, Concepción Universidad de Zaragoza, Zaragoza, Spain
- Ali, Marlina Universiti Teknologi Malaysia, Malaysia
- Almendáriz, Vanessa Escuela Politécnica Nacional, Ecuador
- Alnaqbi, Abdulla Khalifa University, United Arab Emirates
- Alonso Yáñez, Gabriela University of Calgary, Canada
- Alonso-Fernandez, Cristina Faculty of Informatics, Complutense University of Madrid, Spain
- Alperowitz, Lukas Technical University of Munich, Germany
- Alptekin, Mesut University of Paderborn, Germany
- Alrumaih, Hala Al Imam Mohammad Ibn Saud Islamic University, Riyadh, Saudi Arabia
- Alsayyari, Abdulaziz Shaqra University, Saudi Arabia
- Alvarez, Ainhoa UPV/EHU, Spain
- Alvarez Rodriguez, Francisco Javier Universidad Autónoma de Aguascalientes, México
- Alves, Gustavo IPP, Portugal

- Alyammahi, Sohailah Khalifa University, United Arab Emirates
- Alzaghoul, Ahmad Fawaz UPM-POLYTECHNIC UNIVERSITY OF MADRID, Spain
- Andersson, Christina Frankfurt University of Applied Sciences, Germany
- Angel-Fernandez, Julian Mauricio Technische Universität Wien, Austria
- Arnedo-Moreno, Joan Open University of Catalonia, Spain
- Assami, Sara National high school of Computer science and System Analysis (ENSIAS), Morocco
- Assante, Dario International Telematic University Uninettuno, UTIU
- Astrain, David Public University of Navarre, Spain
- Atanasova, Pavlina University of Plovdiv Paisii Hilendarski, Bulgaria
- Auer, Michael IAOE, Austria
- Auret, Lidia Department of Process Engineering, Stellenbosch University, South Africa
- Avgerinos, Evgenios P. Mathematics, Mathematics Education and Multimedia Laboratory, University of the Aegean, Rhodes, Greece
- Avila-Pesantez, Diego San Marcos National University, Peru; Polytechic School of Chimborazo, Ecuador
- Azzouzi, ElMehdi ISMEP-Supmeca, France

- Baez Ramos, Heyson
 Corporación Minuto de Dios, Colombia
- Bagdoniene, Irma Kaunas Science and Technology Park, Lithuania
- Baizan Alvarez, Pablo UNED - Spanish Open University, Spain
- Baldanzi, Valeria University of Pisa, Italy
- Baldassarri, Sandra University of Zaragoza, Spain
- Baltanyan, Sarko Carinthia University of Applied Sciences, Austria
- Banakhr, Fahd Ahmed Yanbu Research Center, Royal Commission Yanbu Colleges and Institutes, Saudi Arabia
- Barada, Hassan Khalifa University, United Arab Emirates
- Barokas, Jack Tel Aviv University, Israel
- Baroni, Marco University of Pisa, Italy
- Barrenechea, Edurne Public University of Navarre, Spain
- Barrios Fleitas, Yeray Universidad de La Laguna, Spain
- Barth, Ingrid Tel Aviv University, Israel
- Bauer, Matthias Hasso Plattner Institute, Germany
- Bazo, Alexander University of Regensburg, Germany

- Beltrán, Adan Universidad Manuela Beltrán, Colombia
- Ben-Yehuda, Margalit ORT Braude College of Engineering, Israel
- Benecke, Dalien Rene University of Johannesburg, South Africa
- Beneder, Roman UAS Technikum Wien, Austria
- Benites, Fernando University of Applied Sciences
- Benlloch-Dualde, José V. Universitat Politècnica de València, Spain
- Berg, Yngvar University College of Southeast Norway
- Bergande, Bianca University of Applied Sciences Neu-Ulm, Germany
- Berkling, Kay Cooperative State University, Germany
- Bermudez, Alejandro Jose *TECSUP*, *Peru*
- Blazquez, Manuel UNED, Spain
- Blazquez-Merino, Manuel P. UNED - Spanish Open University, Spain
- Block, Brit-Maren Leuphana University of Lüneburg, Germany
- Boehmer, Cornelia Hochschule Aschaffenburg, Germany
- Boesch, Chris National University of Singapore, Singapore
- Bogacka, Magdalena Silesian University of Technology, Poland

- Bolodurina, Irina Orenburg State University, Russian Federation
- Borgeest, Kai University of Applied Sciences Aschaffenburg, Germany
- Bosch, Marianna IQS School of Management - Univ. Ramon Llull, Spain
- Braun, Georg University of Applied Science Munich, Germany
- Breitbarth, Kati Fraunhofer Institut fo Digitale Media Technology IDMT, Germany
- Brito, Julio University of La Laguna, Spain
- Broisin, Julien Université de Toulouse, France
- Bruegge, Bernd Technical University of Munich, Germany
- Brück, Rainer Siegen University, Germany
- Buckle, Jane V University of Cambridge, United Kingdom
- Bullón Pérez, Juan José University of Salamanca, Spain
- Burbaite, Renata Kaunas University of Technology, Lithuania
- Burgos, Daniel Universidad Internacional de la Rioja, Spain
- Bustamante, Rogelio Tecnologico de Monterrey, Mexico

- Böttcher, Axel University of Applied Science Munich, Germany
- Böttcher, Axel C.H. niversity of Applied Sciences Munich, Germany
- Caballero, Ismael Institute of Technology and Information Systems, University of Castilla-La Mancha
- Cabeza-Azpiazu, Luis Tecnologico de Monterrey México
- Cabral, Pedro NOVA IMS - Universidade Nova de Lisboa, Lisbon, Portugal
- Caeiro, Manuel Universidad de Vigo
- Caeiro Rodríguez, Manuel IEEE-ES Spanish Chapter, University of Vigo, Spain
- Caeiro Rodríguez, Manuel Universidade de Vigo, Spain
- Calle, Maria Universidad del Norte, Colombia
- Camacho Gonzalez, Yolanda Universidad Autónoma de Nayarit, México
- Candelo Becerra, John Edwin Universidad Nacional de Colombia, Medellín
- Cano Carrillo, Jesus San Pablo CEU University, Madrid, Spain
- Cantrak, Djordje {Svetislav} University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia
- Capasso, Clemente Consiglio Nazionale delle Ricerche - Istituto Motori, Italy

- Cardenas Caceres, Pablo Pontificia Universidad Catolica del Peru, Peru
- Caridade, Cristina Instituto Superior de Engenharia de Coimbra (Portugal), Portugal
- Carrera Rivera, Abdon Universidad de Guayaquil, Ecuador
- Carreño León, Mónica Adriana Universidad Autónoma de Baja California Sur, Mexico
- Carro, German UNED, Spain
- Carroll, Johnson University of Johannesburg, South Africa
- Cascarosa, Esther Universidad de Zaragoza, Zaragoza, Spain
- Castellanos-Nieves, Dagoberto Universidad de La Laguna, Spain
- Castillo Tello, Juan Universidad Internacional de La Rioja, Spain
- Castro Valle, Claudia María Universidad Tecnológica Centroamericana (UNITEC)
- Castro-Gil, Manuel Universidad Nacional de Educacion a Distancia UNED, Spain
- Caviativa, Yaneth Patricia Universidad Manuela Beltrán, Colombia
- Caviativa Castro, Yaneth Patricia Universidad Manuela Beltrán, Colombia
- Cañas Rodríguez, Agustín Gradiant
- Celma, Santiago Universidad de Zaragoza, Zaragoza, Spain

- Cerna, Miloslava
 University of Hradec Králové, Czech Republic
- Chapman, Olive University of Calgary, Canada
- Chatzarakis, George ASPETE
- Chavdarov, Risto Sts Cyril and Methodius University, Faculty of Electrical Engineering and ITs, Skopje, Macedonia, Macedonia, Former Yugoslav Republic of
- Cherkowski, Gina University of Calgary, Canada
- Cheung, Kevin University of Cambridge, United Kingdom
- Chicaiza, Janneth Universidad Técnica Particular de Loja, Ecuador
- Chicaiza Espinosa, Janneth Universidad Técnica Particular de Loja, Ecuador
- Chou, Jui Jen National Taiwan University, Taiwan; National Ilan University, Taiwan
- Christou, Charalambos Stephanou University of Nicosia, Cyprus, Cyprus
- Chung, Szu-Ming Dept. of Digital Content Design, Ling Tung University, Taichung, Taiwan
- Chytas, Christos University of Oldenburg, Germany
- Cieliebak, Mark University of Applied Sciences
- Cipri, Katiuscia La Sapienza, Roma, Italy

- Clarke, Norah University of Johannesburg, South Africa
- Clavijo-Blanco, José Antonio Cadiz University, Spain
- Cobos, Ruth Universidad Autonoma de Madrid, Spain
- Cocu, Adina University "Dunarea de Jos" of Galati, Romania, Romania
- Concilio, Ilana Mackenzie Presbyterian University, Brazil
- Crespo-García, Raquel M. Universidad Carlos III de Madrid, Spain
- Crusat, Xavier InnoEnergy
- Cruz, Bruno Mackenzie Presbyterian University, Brazil
- Cruz-Matus, Lorena Tecnologico de Monterrey México
- Cuellar Cordova, Francisco Pontificia Universidad Catolica del Peru, Peru
- Cueva Carrión, Samanta Patricia Universidad Técnica Particular de Loja, Ecuador
- Cunha de Oliveira, Jefferson William Federal University of Maranhao - Brazil, Brazil
- Czop, Monika Silesian University of Technology, Poland
- Cáceres, M^a José University of Salamanca (Spain)
- Da Costa Neto, Manuel Leonel Federal University of Maranhao - Brazil, Brazil

- Dalipi, Fisnik Linnaeus University, Sweden
- Damaj, Issam American University of Kuwait, Kuwait
- Danese, Giovanni University of Pavia, Italy
- Daneti, Marllene Politehnica University of Timisoara, Romania
- Daoudi, Najima National high school of Computer science and System Analysis (ENSIAS), Morocco
- De Castro, Adela Universidad del Norte, Barranquilla, Colombia
- Deguchi, Daisuke Information Strategy Office, Nagoya University, Japan
- Dele-Ajayi, Opeyemi Northumbria University, United Kingdom
- Delgado Kloos, Carlos UNIVERSIDAD CARLOS III DE MADRID, Spain
- Demarchi, Danilo Politecnico di Torino, Italy
- Demarle-Meusel, Heike Alpen-Adria-Universität Klagenfurt, Austria
- Demlova, Marie The Czech Technical University in Prague, Czech Republic
- Desmulliez, Marc P.Y. Heriot-Watt University, Scotland
- Devine, Amy University of Cambridge, United Kingdom

- Dias Rasteiro, Deolinda Instituto Superior de Engenharia de Coimbra (Portugal), Portugal
- Diaz, Gabriel UNED, Spain
- Diethelm, Ira University of Oldenburg, Germany
- Diez Orueta, Gabriel UNED - Spanish Open University, Spain
- Divitini, Monica Norwegian University of Science and Technology, Norway
- Dodsworth, Dianne University of Calgary, Canada
- Domenach, Florent Basic Education, Akita International University, Akita, Japan
- Doost Mohammadian, Hamid University of Applied Sciences (FHM), Germany
- Doukanari, Elli University of Nicosia, Cyprus, Cyprus
- Douligeris, Christos University of Piraeus, Greece
- Drasute, Vida Kaunas University of Technology, Lithuania
- Dumas, Bruno Université de Namur, Belgium
- Dumitriu, Luminita University "Dunarea de Jos" of Galati, Romania, Romania
- Dzvonyar, Dora Technical University of Munich, Germany
- Ebner, Martin Graz University of Technology, Austria

- Economides, Anastasios University of Macedonia, Greece
- El mezouary, Ali IRF-SIC Laboratory IBN ZOHR University B.P.28 / S - Agadir - Morocco
- El ouali, Mehdi International University of Rabat, Morocco
- El-Abd, Mohammed American University of Kuwait, Kuwait
- El-Hassan, Hilal UAE University, United Arab Emirates
- El-Maaddawy, Tamer UAE University, United Arab Emirates
- Eldeib, Ayman Cairo University, Egypt
- Emembolu, Itoro Northumbria University, United Kingdom
- Enciso, Liliana Universidad Tecnica Particular de Loja, Ecuador
- Ender, Ferenc Budapest University of Technology and Economics, Hungary
- Engelbrecht, Lisa University of Applied Sciences and Arts Coburg, Germany
- Epaminonda, Epaminondas University of Nicosia, Cyprus, Cyprus
- Escudeiro, Nuno ISEP /GILT, Portugal
- Escudeiro, Paula Maria ISEP /GILT, Portugal
- Espejo Mojica, Oscar Gabriel Corporación Minuto de Dios, Colombia

- Estévez Costas, Andrés Gradiant
- Estévez-Ayres, Iria UNIVERSIDAD CARLOS III DE MADRID, Spain
- Evangelidis, Georgios University of Macedonia, Greece
- Fabregat, Ramon Universitat de Girona, Spain
- Falkenberg, Egbert Frankfurt University of Applied Sciences, Germany
- Fan, Hua University of Electronic Science and Technology of China, China, People's Republic of
- Fantozzi, Fabio University of Pisa, Italy
- Feldmann, Nina Hochschule Aschaffenburg, Germany
- Fernando, Shantha University of Moratuwa, Sri Lanka
- Fernández Hermida, David Gradiant
- Fernández Manjon, Baltasar Universidad Complutense de Madrid, Spain
- Fidalgo, Andre IPP, Portugal
- Fischer, Tim Heilbronn University, Germany
- Flamini, Marta Università Telematica Internazionale UNINETTUNO, Italy
- Florensa, Ignasi EUSS-Univ. Autònoma de Barcelona, Spain

- Fontani, Marina University of Pisa, Italy
- Francis, Krista University of Calgary, Canada
- Francois, Alexis University of Cergy-Pontoise, France
- Fransson, Torsten Henry EIT InnoEnergy, Netherlands
- Freire, Manuel Faculty of Informatics, Complutense University of Madrid, Spain
- Freire Moran, Manuel Universidad Complutense de Madrid, Spain
- Friesen, Sharon University of Calgary, Canada
- Friss de Kereki, Ines Universidad ORT Uruguay, Uruguay
- Fritzsche, Eva Susanne Technical University of Munich, Germany
- Froyd, Jeffrey Ohio State University, United States of America
- Fuchs, Michael Wilhelm Büchner University of Applied Sciences, Pfungstadt; Germany
- Fuchs, Simon FernUniversität in Hagen; Germany
- Fuentes Pérez, Alexis Daniel Universidad de La Laguna, Spain
- Futschek, Gerald Vienna University of Technology, Austria
- Förster, Emmy-Charlotte Hastily Assembled Games, Germany
- Förster, Klaus-Tycho University of Vienna, Austria

- Gabriela Calle, María Universidad del Norte, Barranquilla, Colombia
- Gaile-Sarkane, Elina Riga Technical University, Latvia
- Gamage, Dilrukshi University of Moratuwa, Sri Lanka
- Gamer, Sergei Technion - Israel Institute of Technology, Israel
- Gandolfi, Roberto University of Pavia, Italy
- Gaona, Paulo Alonso Universidad Distrital Francisco José de Caldas
- Garbi-Zutin, Danilo IAOE, Austria
- Garcia, Nuno Instituto de Telecomunicações, Lisboa, Portugal; Universidade da Beira Interior, Covilhã, Portugal; Universidade Lusófona de Humanidades e Tecnologias, Lisboa, Portugal
- Garcia Loro, Felix UNED - Spanish Open University, Spain
- Garcia-Hernandez, Carla EVM, Spain
- Garcia-Loro, Felix UNED, Spain
- Garcia-Zubia, Javier UDEUSTO, Spain
- García, Lucy Universidad del Norte, Barranquilla, Colombia
- García Herrera, Darwin G. Universidad Tecnica de Ambato, Ecuador, Facultad de Ciencias Humanas y de la Educación

- García-Holgado, Alicia GRIAL Research Group, University of Salamanca, Spain
- García-Peñalvo, Francisco J. GRIAL Research Group, University of Salamanca, Spain
- Gascón, Josep Univ. Autònoma de Barcelona, Spain
- Gatto, Guilherme Mackenzie Presbyterian University, Brazil
- Gaustad, André Norwegian University of Science and Technology, Norway
- Gautestad, Harald H. Tangen upper secondary school, Kristiansand, Norway
- Gayoso Martinez, Víctor Spanish National Research Council (CSIC), Madrid, Spain
- Gereluk, Dianne University of Calgary, Canada
- Ghanipoor Machiani, Sahar San Diego State University, USA
- Giannakos, Michail Norwegian University of Science and Technology, Norway
- Gianni, Francesco Norwegian University of Science and Technology, Norway
- Gil, Rosa Maria Universitat de LLeida, Spain
- Gil-Salom, Daniela Universitat Politècnica de València, Spain
- Gil-Vicente, Pedro J. Universitat Politècnica de València, Spain

- Gil-de-Castro, Aurora Universidad de Cordoba, Spain
- Gimeno, Cecilia
 Université catholique de Louvain, Louvain-la Neuve, Belgium
- Gkotsiopoulos, Panagiotis University of Piraeus, Greece
- Gochev, Ivan Sts Cyril and Methodius University, Faculty of Electrical Engineering and ITs, Skopje, Macedonia, Macedonia, Former Yugoslav Republic of
- Gocheva-Ilieva, Snezhana University of Plovdiv Paisii Hilendarski, Bulgaria
- Gold-Veerkamp, Carolin University of Applied Sciences Aschaffenburg, Germany
- Gomes, Ane Caroline Santos Mackenzie Presbyterian University, Brazil
- Gomez, María Clara Universidad de Medellín, Colombia
- Gonzalez, Jose Saul Universidad Autonoma de Cd. Juarez, Mexico
- González, Carina Universidad de la Laguna, Spain
- González Crespo, Rubén Universidad Internacional de La Rioja (UNIR), Spain
- González González, Carina Universidad de La Laguna, Spain
- Goosen, Neill Stellenbosch University, South Africa
- Gqibani, Samuel University of Johannesburg, South Africa

- Grammatikou, Mary National Technical University of Athens, Greece
- Greeff, Jacob Jacobus North-West University, South Africa
- Grodd, Sarah Fraunhofer Institut fo Digitale Media Technology IDMT, Germany
- Grotz, Norbert Kempten University, Germany
- Großkreutz, Damian Frankfurt University of Applied Sciences, Germany
- Gruber, Hans University of Regensburg, Germany; University of Turku, Finland
- Gruhler, Gerhard Heilbronn University, Germany
- von Grünigen, Dirk University of Applied Sciences
- Gu, Haiyun Department of Electronic Engineering, Shanghai Maritime University, China
- Gubia, Eugenio Public University of Navarre, Spain
- Guenther, Elisabeth Anna Cranfield School of Management, United Kingdom
- Guerrero, Fernando Solid Q, Spain
- Gumaelius, Lena KTH Royal Institute of Technology, Sweden
- Gustavsson, Ingvar BTH, Sweden
- Gómez del Río, Nazareth Universidad de La Laguna, Spain

- Haak, Valentin University of Applied Sciences Aschaffenburg, Germany
- Haberstroh, Max IMA/ZLW - RWTH Aachen University, Germany
- Hadjerrouit, Said University of Agder, Kristiansand, Norway
- Hagström, Peter Royal Institute of Technology (KTH)
- Hammer, Sabine niversity of Applied Sciences Munich, Germany
- Hauser, Florian OTH Regensburg, Germany
- Havenga, Marietjie North-West University, South Africa
- Heberle, Andreas University of Applied Sciences Karlsruhe, Germany
- Heckner, Markus Technical University of Applied Sciences Regensburg, Germany
- Heidman, Olivier University of Thessaly, Greece
- Hemmje, Matthias FernUniversität in Hagen, Germany
- Henao, Alvin Universidad del Norte, Colombia
- Henry, Julie Université de Namur, Belgium
- Henze, Dominic Technical University of Munich, Germany
- Hernandez Berlinches, Roberto Department of Communication and Control System, UNED, Madrid, Spain

- Hernandez Perdomo, Wilmar Universidad de las Americas
- Hernandez-Ambato, Jorge Polytechnic School of Chimborazo, Ecuador
- Hernandez-Jayo, Unai UDEUSTO, Spain
- Hernandez-Luna, Alberto Tecnologico de Monterrey México
- Hernández Encinas, Ascensión University of Salamanca, Spain
- Herring, George K. Stanford University, United States of America
- Hertzog, Pierre Eduard Central University of Technology, Free State (CUT), South Africa
- Hesselink, Lambertus Stanford University, United States of America
- Heymann, Reolyn University of Johannesburg, South Africa
- Hobelsberger, Martin University of Applied Science Munich, Germany
- Housden, Mike University of Cambridge, United Kingdom
- Huang, Chun-Hsiung Dept. of Digital Content Design, Ling Tung University, Taichung, Taiwan
- Högfeldt, Anna-Karin KTH Royal Institute of Technology, Sweden
- Ibrahim, Nor Hasniza Universiti Teknologi Malaysia, Malaysia
- Ibsen, Michael Xisio Informationssysteme GmbH

- Ibáñez, María Blanca Universidad Carlos III de Madrid, Spain
- Ilic, Dejan {Bogoljub} University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia
- Ilic, Dejan Bogoljub University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia
- Iliev, Anton University of Plovdiv Paisii Hilendarski, Bulgaria
- Imenes, Kristin University College of Southeast Norway, Norway
- Impagliazzo, John Hofstra University, United States of America
- Imran, Ali Norwegian University of Science and Technology (NTNU), Norway
- Incekara, Mehmet Ali Cooperative State University, Germany
- Infante Paredes, Ruth Universidad Tecnica de Ambato, Ecuador, Facultad de Ciencias Humanas y de la Educación
- Iqbal, Hafiz Tecnológico de Monterrey, México
- Iqbal, Muhammad Javed Yanbu Research Center, Royal Commission Yanbu Colleges and Institutes, Saudi Arabia
- Isenhardt, Ingrid IMA/ZLW - RWTH Aachen University, Germany
- Isenhardt, Ingrid IMA/ZLW der RWTH Aachen, Germany

- Ito, Kazunari Aoyama Gakuin University, Japan
- Ito, Ryuya Graduate School of Information Science, Nagoya University, Japan
- Ivanov, Atanas University of Plovdiv Paisii Hilendarski, Bulgaria
- Izquierdo, Dennis TECSUP, Peru
- Izquierdo, Javier Tecnologico de Monterrey, Mexico
- Jaccheri, Letizia Norwegian University of Science and Technology (NTNU), Norway
- Jankovic, Novica {Zvonko} University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia
- Jankovic, Novica Zvonko University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia
- Janse van Rensburg, Nickey University of Johannesburg, South Africa
- Jaramillo, Valentino Universidad Manuela Beltrán, Colombia
- Jaramillo Hurtado, Danilo Rubén Universidad Técnica Particular de Loja, Ecuador
- Jarnig, Maria Alpen-Adria-Universität Klagenfurt, Austria
- Jayasuriya, Jeevan Perera Weeraratne Royal Institute of Technology (KTH), Stockholm, Sweden; EIT InnoEnergy, Stockholm, Sweden
- Jeannin, Laurent EBI, France

- Jesmin, Triinu Tallin University, Stonia
- Jiménez-Castañeda, Rafael Cadiz University, Spain
- Jodłowski, Grzegorz Stefan AGH University of Science and Technology, Poland
- Jové, Teodor Universitat de Girona, Spain
- João, Isabel M. ISEL - Instituto Superior de Engenharia de Lisboa, Instituto Politécnico de Lisboa; CEG-IST, Instituto Superior Técnico, Universidade de Lisboa, Portugal
- Jurado, Francisco Universidad Autonoma de Madrid, Spain
- Kalovrektis, Konstantinos School Teacher, Levadeia
- Kalz, Marco UNESCO Chair of Open Education, Faculty of Management, Science and Technology & Welten Institute, Open University of the Netherlands, Netherlands
- Kampmann, Matthias Ostbayerische Technische Hochschule (OTH) Regensburg, Germany
- Karayiannis, Achilleas Kes College
- Kassou, Ismail Mohammed V University, Rabat, Morocco
- Kastelan, Ivan University of Novi Sad, Faculty of Technical Sciences, Serbia
- Kastl, Petra Friedrich-Alexander Universität Erlangen-Nürnberg, Germany

- Kastrati, Zenun Norwegian University of Science and Technology (NTNU), Norway
- Khalil, Mohammad Delft University of Technology, Netherlands, The
- Khaouja, Imane International University of Rabat, Morocco; Mohammed V University, Rabat, Morocco
- Khoroshko, Alexey Leonidovich Moscow Aviation Institute (National Research University), Russian Federation
- Kis, Juliane OTH Regensburg, Germany
- Kitsios, Fotis University of Macedonia, Greece
- Kleftodimos, Alexandros Western Macedonia University of Applied Sciences, Greece
- Klinger, Thomas Carinthia University of Applied Sciences, Austria
- Klopp, Marco University of applied sciences Aschaffenburg, Germany
- Klossek, Martin eWorks GmbH, Germany
- Knowlton Cockett, Polly University of Calgary, Canada
- Koleilat, Musbah CEFET/RJ, Brazil
- Kolski, Christophe Université de Valenciennes, LAMIH-UMR CNRS 8201, Le Mont-Houy – Valenciennes, France
- Komura, Ryotaro National Institute of Technology, Ishikawa College, Japan

- de Koning, Björn Erasmus University Rotterdam, Netherlands, The
- Kordts-Freudinger, Robert Paderborn University, Germany
- Krcmar, Helmut Technical University of Munich, Germany
- Kreiter, Christian Carinthia University of Applied Sciences, Austria
- Krogstie, Birgit Rognebakke Norwegian University of Science and Technology, Norway
- Krogstie, John Norwegian University of Science and Technology, Norway
- Ktoridou, Despo University of Nicosia, Cyprus, Cyprus
- Kulesza, Wlodek BTH, Sweden
- Kulina, Hristina University of Plovdiv Paisii Hilendarski, Bulgaria
- Kunicina, Nadezhda Riga Technical University, Latvia
- Kurdia, Anastasia Tulane University, United States of America
- Kusmin, Marge Tallinn University, Estonia
- Kvittem, Dag R. Markaplassen Ungdomsskole, Norway
- Kyriacou, Kyriacos University of Nicosia, Cyprus

- Köhler, Thomas Martin-Luther-Universität Halle-Wittenberg, Germany
- Kęsik, Jacek Lublin University of Technology, Poland
- Laanpere, Mart Tallinn University, Estonia
- Lama Penin, Manuel Universidade de Santiago de Compostela, Spain
- Lamas, David Tallinn University, Tallinn, Estonia
- Landes, Dieter Coburg University of Applied Sciences and Arts, Germany
- Langmann, Reinhard Duesseldorf University of Applied Sciences, Germany
- Lanthony, Antoine ISMEP-Supmeca, France
- Lantz, Ann KTH Royal Institute of Technology, Sweden
- Larco, Andrés Escuela Politécnica Nacional, Ecuador
- Larranaga, Mikel UPV/EHU, Spain
- Lavarde, Marc EBI, France
- Lavirotte, Stephane Université Nice-Sophia Antipolis, France
- Leccese, Francesco University of Pisa, Italy
- Lechner, Markus UAS Technikum Wien, Austria
- Legashev, Leonid Orenburg State University, Russian Federation

- Lehmann, Alexander Coburg University of Applied Sciences and Arts, Germany
- Lehtikangas, Elina OMNIA, Finland
- Leisenberg, Manfred Fachhochschule des Mittelstands, Germany
- Leleito, Emanuel Nagoya University, Japan
- Levkovskyi, Borys Technical University of Munich, Germany
- Lin, Hui-Guan Dept. of Digital Content Design, Ling Tung University, Taichung, Taiwan
- Llamas, Martin Universidad de Vigo
- Llamas Nistal, Martín IEEE-ES Spanish Chapter, University of Vigo, Spain
- Llopis Pascual, Fernando University of Alicante, Spain
- Lluma-Noboa, Amarilis Polytechnic School of Chimborazo, Ecuador
- Logofatu, Doina Frankfurt University of Applied Sciences, Germany
- Lopez-Martin, Antonio Public University of Navarre, Spain
- Lopez-Taberna, Jesus Public University of Navarre, Spain
- Louw, Tobias Muller Stellenbosch University, South Africa
- Lucht, Martina Fraunhofer Institut fo Digitale Media Technology IDMT, Germany

- Lujara, Suzan DIT, Dar Es Salam Institute of Technology, Tanzania
- Luján-Mora, Sergio Universidad de Alicante
- Lundberg, Gunhild Marie Norwegian University of Science and Technology, Norway
- López, Jorge Universidad Técnica Particular de Loja, Ecuador
- Löffler, Alexander Technical University of Munich, Germany
- Löwe, Thomas Hastily Assembled Games, Germany
- M. Carley, Kathleen Carnegie Mellon University
- M. Villanueva, Nora Gradiant
- Machado Ferreira, Carlos Instituto Superior de Engenharia de Coimbra, Portugal
- Macho, Alejandro UNED, Spain
- Macho Aroca, Alejandro UNED - Spanish Open University, Spain
- Maciel Barbosa, Fernando Faculdade de Engenharia da Universidade do Porto, Porto
- Madeira, Viviane CEFET/RJ, Brazil
- Madritsch, Christian Carinthia University of Applied Sciences, Austria
- Magid, Amani New York University Abu Dhabi

- Mahani, Zouhir LASIME Laboratory IBN ZOHR University B.P.28 / S - Agadir - Morocco
- Malchow, Martin Hasso Plattner Institute, Germany
- Mangiavacchi, Elena University of Pisa, Italy
- Manseur, Rachid SUNY Oswego, United States of America
- Manso, Mario Universidade de Vigo, Spain
- Mansour, Yasser El-Husseini Ibrahim Prince Sultan University, Saudi Arabia; Zagazig University, Structural Engineering Department
- Marchesini, Piera Mackenzie Presbyterian University, Brazil
- Marenzi, Elisa University of Pavia, Italy
- Marey, Mohamed Fawzy Prince Sultan University, Saudi Arabia; Menoufia University, Faculty of Electronic Engineering
- Marques, Arcelina IPP, Portugal
- Martinez, María de los Angeles Tech and ladies, Spain; Women Techmakers, United States of America
- Martinez Bonastre, Oscar Universidad Miguel Hernández
- Martinez Diaz, Mar KU Leuven, Belgium
- Martinez-Ortiz, Ivan Faculty of Informatics, Complutense University of Madrid, Spain

- Martín, Sergio UNED, Spain
- Martín González, Raquel Universidad de La Laguna, Spain
- Martín del Rey, Ángel University of Salamanca, Spain
- Martín-Vaquero, Jesús University of Salamanca (Spain)
- Martínez-Monés, Alejandra GSIC-EMIC Research Group, Universidad de Valladolid, Spain
- Matabuena, David Universidad de Cordoba, Spain
- Matias, Ignacio R. Public University of Navarre, Spain
- Matias, Igor Instituto de Telecomunicações, Lisboa, Portugal; Universidade da Beira Interior, Covilhã, Portugal
- Matijevic, Milan {Slavko} University of Kragujevac, Faculty of Engineering, Kragujevac, Serbia
- Matsuoka, Masato Kaspersky Lab
- Mauricio, David State University of San Marcos
- Mavroudi, Anna Norwegian University of Science and Technology, Norway
- Maya, Isidro Universidad de Sevilla, Spain
- Mayorga Díaz, Monica Patricia Universidad Regional Autónoma de Los Andes UNIANDES, Facultad de Sistemas Mercantiles
- McElwee, Sarah University of Cambridge, United Kingdom

- Medina-Gracia, Ricardo Universidad de Cordoba, Spain
- Meinel, Christoph Hasso Plattner Institute, Germany
- Mello, Andréa Justino Ribeiro CEFET/RJ, Brazil
- Mello, José André Villas Boas CEFET/RJ, Brazil
- Mena, Juanjo GRIAL Research Group, University of Salamanca, Spain
- Mena Arzú, Dania Valentina Universidad Tecnológica Centroamericana (UNITEC); Universidad de Extremadura
- Menacho, Antonio UNED, Spain
- Meneses-Ortegón, Juan Pablo Universitat de Girona, Spain
- Mengual Andres, Santiago Universitat de ValEncia
- Menz, Monika Fraunhofer Institut fo Digitale Media Technology IDMT, Germany
- Menéndez Mora, Raúl Ernesto Universidad Manuela Beltrán, Colombia
- Meyer, Dany University of Applied Sciences Neu-Ulm, Germany
- Meyer, Johan University of Johannesburg, South Africa
- Mezzour, Ghita International University of Rabat, Morocco
- Migliori, Marco Oreste Cedel Cooperativa Sociale ELIS, Italy

• Mihova, Marija

Ss. Cyril and Methodius University in Skopje, Macedonia, Macedonia, Former Yugoslav Republic of

- Mikalef, Patrick Norwegian University of Science and Technology (NTNU), Norway
- Mikic Fonte, Fernando A. IEEE-ES Spanish Chapter, University of Vigo, Spain
- Milosz, Elzbieta Lublin University of Technology, Poland
- Milosz, Marek Lublin University of Technology, Poland
- Miranda Valladares, Gara Universidad de La Laguna, Spain
- Mirmotahari, Omid Universitetet i Oslo, Norway
- Mirowski, Tomasz Polish Academy of Sciences, Mineral and Energy Economy Research Institute, Cracow, Poland
- Mladenovic, Milos Aalto University, Finland
- Moggio, Martina University of Pisa, Italy
- Mohammad, Walid Bangladesh University of Engineering and Technology, Dhaka, Bangladesh.
- Montenegro-Marín, Carlos Enrique Universidad Distrital Francisco José de Caldas
- Montusiewicz, Jerzy Lublin University of Technology, Poland
- Mora, Simone Norwegian University of Science and Technology, Norway

- Mora Carreño, Alberto Open University of Catalonia, Spain
- Morales-Menendez, Ruben Tecnológico de Monterrey, México
- Moreno, Joan Arnedo Universitat Oberta de Catalunya, Barcelona, Spain
- Moreno León, Jesús Instituto Nacional de Tecnologías Educativas y Formación del Profesorado, Spain
- Moreno-Garcia, Isabel Universidad de Cordoba, Spain
- Moreno-Marcos, Pedro Manuel UNIVERSIDAD CARLOS III DE MADRID, Spain
- Moreno-Munoz, Antonio Universidad de Cordoba, Spain
- Moreno-Ruiz, Jesús Cadiz University, Spain
- Moreno-Ruiz, Lorenzo Universidad de La Laguna, Spain
- Mori, Giulia University of Pisa, Italy
- Moscinska, Katarzyna Silesian University of Technology, Poland
- Mottok, Jürgen OTH Regensburg, Germany
- Mouchou Tchamdjeu, Rosine University of Johannesburg, South Africa
- Mozgaleva, Alena Tomsk State University, Russian Federation
- Mozgaleva, Polina Tomsk Polytechnic University, Russian Federation

- Mucientes, Manuel Universidade de Santiago de Compostela, Spain
- Muharremi, Fitore Frankfurt University of Applied Sciences, Germany
- Muñoz Arteaga, Jaime Autonomous University of Aguascalientes, Mexico
- Muñoz Cruz, Vanesa Universidad de La Laguna, Spain
- Muñoz Merino, Pedro José Universidad Carlos III de Madrid, Spain
- Más-Estellés, Jorge Universitat Politècnica de València, Spain
- Nacke, Lennart E. Open University of Catalonia, Spain
- Nadzinski, Gorjan Sts Cyril and Methodius University, Faculty of Electrical Engineering and ITs, Skopje, Macedonia, Macedonia, Former Yugoslav Republic of
- Nascimbeni, Fabio
 Universidad Internacional de la Rioja, Spain
- Navarro, Jórdi Sánchez Universitat Oberta de Catalunya, Barcelona, Spain
- Navarro Adelantado, Vicente Universidad de La Laguna, Spain
- Nawab, Mohammad Sadique Shaqra University, Saudi Arabia
- Nedeljkovic, Milos {Srecko} University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia
- Nel, Andre University of Johannesburg, South Africa

- Nel, Andre Leon University of Johannesburg, South Africa
- Neumann, Rainer University of Applied Sciences Karlsruhe, Germany
- Neustock, Lars Thorben Stanford University, United States of America
- Neves Rodrigues, Luis Henrique Federal University of Maranhao - Brazil, Brazil
- Nevmerzhitskaya, Julia Laurea University of Applied Sciences, Finland
- Nieh, Tsung Hsuan National Taiwan University, Taiwan
- Nieto Acevedo, Yuri Vanessa Corporación Unificada Nacional de Educación Superior CUN
- Nikou, Stavros University of Macedonia, Greece
- Nilsson, Kristian BTH, Sweden
- Nishiyama, Kiyohisa Nagoya University, Japan
- Nofen, Barbara University of Paderborn, Germany
- Nordgreen, Thomas Royal Institute of Technology (KTH)
- Nurjanah, Dade Telkom University, Indonesia
- Nussbaumer, Alexander Technische Universität Graz, Austria
- Ohira, Shigeki Information Technology Center, Nagoya University, Japan

- Oikonomopoulou, Martha Mathematics teacher
- Okamoto, Kosuke Graduate School of Information Science, Nagoya University, Japan
- Oliveira, Tiago ISEP /GILT, Portugal
- Oliveros, Ingrid Universidad del Norte, Colombia
- Olmedo-Vizueta, Diana Polytechnic School of Chimborazo, Ecuador
- Olwagen, Lienie Central University of Technology, South Africa
- Oros, Ramona CUAS, Austria
- Orta, Pedro Tecnológico de Monterrey, México
- Ortega, Gloria University of Almería, Spain
- Ortega-Arranz, Alejandro GSIC-EMIC Research Group, Universidad de Valladolid, Spain
- Ospina Carvajal, Juan José Universidad Nacional de Colombia
- Paas, Fred Erasmus University Rotterdam, Netherlands, The; Early Start Research Institute, University of Wollongong, Australia
- Pacheco, Alfredo TECSUP, Peru
- Paderewski, Patricia Universidad de Granada, Spain
- Padilla, Natalia Universidad de La Rioja, Spain

- Pallares-Lopez, Victor Universidad de Cordoba, Spain
- Pancratz, Nils University of Oldenburg, Germany
- Panthalookaran, Varghese Rajagiri School of Engineering & Technology, India
- Papamitsiou, Zacharoula University of Macedonia, Greece
- Papavlasopouloou, Sofia Norwegian University of Science and Technology, Norway
- Pappas, Ilias Norwegian University of Science and Technology (NTNU), Norway
- Pappas, Ilias Norwegian University of Science and Technology, Norway
- Paredes Venero, Renato Pontificia Universidad Catolica del Peru , Peru
- Paredes-Velastegui, Daniela Polytechnic School of Chimborazo, Ecuador
- Parra-Saldivar, Roberto Massachusetts Institute of Technology, USA
- Pascoal, Alcino Madan Parque, Portugal
- Pastor Vargas, Rafael Department of Communication and Control System, UNED, Madrid, Spain
- Pawelczak, Dieter UniBw Munich, Germany
- Pears, Arnold Neville Uppsala University, Sweden

- Pecheanu, Emilia University "Dunarea de Jos" of Galati, Romania, Romania
- Pedonese, Chiara University of Pisa, Italy
- Peers, Matthew Northumbria University, United Kingdom
- Peixoto, Aruquia CEFET/RJ, Brazil
- Perera, Indika University of Moratuwa, Sri Lanka
- Perez-Artieda, Gurutze Public University of Navarre, Spain
- Perez-Castillo, Ricardo Institute of Technology and Information Systems, University of Castilla-La Mancha
- Perez-Colado, Ivan Faculty of Informatics, Complutense University of Madrid, Spain
- Perez-Molina, Clara Maria UNED, Spain
- Perifanou, Maria University of Macedonia, Information Systems IPPS, Greece
- Pessoa Filho, Joaquim Mackenzie Presbyterian University, Brazil
- Pester, Andreas Carinthia University of Applied Sciences, Austria
- Pester, Andreas CUAS, Austria
- Petlenkov, Eduard Tallinn University of Technology, Estonia
- Peyret, Nicolas ISMEP-Supmeca, France; QUARTZ laboratory – EA 7393, France

- Piedra, Nelson Universidad Técnica Particular de Loja, Ecuador
- Pikoń, Krzysztof Silesian University of Technology, Poland
- Pinedo Rivera, Dafne Ifigenia Autonomous University of Aguascalientes, Mexico
- Plaza, Inmaculada IEEE-ES Spanish Chapter, University of Zaragoza, Spain
- Plaza, Pedro PLAZA ROBOTICA, Spain
- Polezhaev, Petr Orenburg State University, Russian Federation
- Polishuk, Alex Technion - Israel Institute of Technology, Israel
- Pombo, Nuno Instituto de Telecomunicações, Lisboa, Portugal; Universidade da Beira Interior, Covilhã, Portugal; Universidade Lusófona de Humanidades e Tecnologias, Lisboa, Portugal
- Ponce Gallegos, Julio Cesar Autonomous University of Aguascalientes, Mexico
- Popescu-Braileanub, Beatrice Instituto Astrofísico de Canarias, Spain
- Popovic, Miroslav University of Novi Sad, Faculty of Technical Sciences, Serbia
- Portides, George University of Nicosia, Cyprus
- Pott, Robert Stellenbosch University, South Africa

- Poulova, Petra University of Hradec Králové, Czech Republic
- Pradarelli, Beatrice, Severine University of Montpellier, France
- Preciado Babb, Armando Paulino University of Calgary, Canada
- Prifti, Loina Technical University of Munich, Germany
- Psycharis, Sarantos ASPETE and Visting Professor Huddersfield University, Greece
- Pundak, David ORT Braude College, Israel & Kinneret College, Israel
- Páez Quinde, Cristina Universidad Tecnica de Ambato, Ecuador, Facultad de Ciencias Humanas y de la Educación
- Pérez Colado, Victor Manuel Universidad Complutense de Madrid, Spain
- Queiruga Dios, Araceli University of Salamanca (Spain)
- Quezada Pena, Jose Roberto Federal University of Maranhao - Brazil, Brazil
- Quezada-Sarmiento, Pablo Alejandro Universidad Internacional del Ecuador
- Quoniam, Luc Université de Toulon, France
- Rahhal, Ibrahim International University of Rabat, Morocco; Mohammed V University, Rabat, Morocco
- Rainer, Javier Universidad Internacional de La Rioja, Spain

- Rajamäki, Jyri Laurea University of Applied sciences, Finland
- Raleva, Katerina Sts Cyril and Methodius University, Faculty of Electrical Engineering and ITs, Skopje, Macedonia, Macedonia, Former Yugoslav Republic of
- Ramirez-Mendoza, Ricardo A. Tecnologico de Monterrey México
- Ramírez, Germán Augusto Universidad Manuela Beltrán, Colombia; Universidad Nacional de Colombia
- Raud, Zoja Tallinn University of Technology, Estonia
- Raveh, Ira ORT Braude College, Israel
- Raza, Ali RIT Dubai, Dubai, U.A.E
- Rechkoski, Ljupcho Ss. Cyril and Methodius University in Skopje, Macedonia, Macedonia, Former Yugoslav Republic of
- Regier, Stefanie University of Applied Sciences Karlsruhe, Germany
- Remoundou, Demetra Mathematics, Mathematics Education and Multimedia Laboratory, University of the Aegean, Rhodes, Greece
- Ren, Lei Department of Electronic Engineering, Shanghai Maritime University, China
- Rencz, Marta Budapest University of Technology and Economics, Hungary
- Restivo, Maria Teresa University of Porto, Portugal

- Restivo, Maria Teresa University of Porto, Portugal
- Restivo, Teresa University of Porto, Portugal, Portugal
- Reuter, Rebecca OTH Regensburg, Germany
- Rey, Gaetan Université Nice-Sophia Antipolis, France
- Reymond, David Université de Toulon, France
- Ribickis, Leonids Riga Technical University, Latvia
- Richert, Anja IMA/ZLW der RWTH Aachen, Germany
- Rios, Horacio Tecnologico de Monterrey México
- Ripoll, Lacides Universidad del Norte, Colombia
- Rivera, Luis North Fluminense State University, Brazil; San Marcos National University, Peru
- Robles, Gregorio Universidad Rey Juan Carlos, Spain
- Robson, David University of Cambridge, United Kingdom
- Roca, Javier University of Almería, Spain
- Rodrigues, Gustavo Soares Mascarenhas Mackenzie Presbyterian University, Brazil
- Rodriguez-Artacho, Miguel Universidad Nacional de Educacion a Distancia UNED, Spain
- Rodríguez, Gerardo University of Salamanca (Spain)

Rodríguez, Moisés

Institute of Technology and Information Systems, University of Castilla-La Mancha; AQ-CLab Software and Data Quality Laboratory

- Rodríguez Morales, Germania del Rocío Universidad Técnica Particular de Loja, Ecuador
- Rodríguez Sánchez, Gerardo University of Salamanca, Spain
- Rodríguez-Conde, María José GRIAL Research Group, University of Salamanca, Spain
- Rodríguez-Gonzalvez, Pablo TIDOP Research Group University of Salamanca (Spain), Spain; University of Leon (Spain)
- Rodríguez-Martín, Manuel TIDOP Research Group University of Salamanca (Spain), Spain; Catholic University of Avila (Spain)
- Rodríguez-Morales, Germania Universidad Tecnica Particular de Loja, Ecuador
- Romano, Elpidio Università Telematica Internazionale UNINETTUNO, Italy
- Romeike, Ralf Friedrich-Alexander Universität Erlangen-Nürnberg, Germany
- Romero Hortelano, Miguel Department of Communication and Control System, UNED, Madrid, Spain
- Román González, Marcos Universidad Nacional de Educación a Distancia, Spain
- Rotaru, Dan Cristian Universidad Complutense de Madrid, Spain

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- Lehmann, Alexander (Germany) Coburg University of Applied Sciences and Arts

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- Raleva, Katerina (Republic of Macedonia) Sts Cyril and Methodius University, Faculty of Electrical Engineering and ITs, Skopje, Macedonia
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- Revuelta, Francisco (Spain) University of Extremadura
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- Rösel, Birgit (Germany) OTH Regensburg
- Rüütmann, Tiia (Estonia) Tallinn University of Technology
- SOMKUWAR, VANDANA (India) NITTTR
- SUSNEA, Ioan (Romania) University "Dunarea de Jos" of Galati, Romania

- Saar, Merike (Estonia) Tallinn University
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- Sedelmaier, Yvonne (Germany) Coburg University of Applied Sciences and Arts
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- Sentance, Su (United Kingdom) King's College London
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- Standl, Bernhard (Austria) Vienna University of Technology
- Stankovski, Mile (Republic of Macedonia) University Kilril and Methodii
- van der Stappen, Esther (Netherlands) HU University of Applied Sciences Utrecht
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- Travassos Valdez, Manuel (Portugal) Instituto Superior de Engenharia de Coimbra
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- Tsiatsos, Thrasyvoulos G. (Greece) Aristotle University of Thessaloniki

- Tundjungsari, Vitri (Indonesia) YARSI University
- Tzanova, Slavka (Bulgaria) Technical University of Sofia
- Urbano, Diana (Portugal) University of Porto, Portugal
- Ursutiu, Doru (Romania) University "Transilvania" Brasov - CVTC
- Utesch, Matthias (Germany) Staatliche Fach- und Berufsoberschule Technik München und Technische Universität München
- Vainio, Teija (Finland) University of Tampere
- Valadares, Eduardo de Campos (Brazil) UFMG
- Valderrama, César (Spain) Universitat Politècnica de Catalunya · Barcelona Tech
- Vallejo-Figueroa, Santa (Spain) UNED - Escuela Internacional de Doctorado
- Vavougios, Denis (Greece) University of Thessaly
- Vaz de Carvalho, Carlos (Portugal) Instituto Superior de Engenharia do Porto
- Vega Navarro, Ana Vega (Spain) Universidad de La Laguna
- Veljovic, Aleksandra, Milic (Serbia) Faculty of Engineering at University of Kragujevac
- Veneri, Ottorino (Italy) National Research Council of Italy
- Venter, Marisa Isabel (South Africa) Central University of Technology

- Verner, Igor (Israel) Technion - Israel Institute of Technology
- Villamañe, Mikel (Spain) University of the Basque Country UPV/EHU
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- Weitschek, Emanuel (Italy) Università Telematica Internazionale Uninettuno
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- Winterfeldt, Götz (Germany) TH Deggendorf
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- Wolfer, James (United States) Indiana University South Bend
- Wolff, Christian (Germany) Regensburg University

- Wolff, Karin Elizabeth (South Africa) Cape Peninsula University of Technology
- Woolf, Beverly (United States) University of Massachussent
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- Xalabarde, Alain
- Xinogalos, Stelios (Greece) University of Macedonia
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- Yilmaz, Fatih (Turkey) Gazi University (Ankara), Turkey
- Yonemura, Keiichi (Japan) National Institute of Technology, Kisarazu College
- Yousafzai, Jibran Khan (Kuwait) American University of Kuwait
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- Zakova, Katarina (Slovakia) Slovak University of Technology
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- Zvacek, Susan (United States) Higher Education Consultant
- Záhorec, Ján (Slovakia) Comenius University in Bratislava
- da Cunha Reis, Augusto (Brazil) CEFET/RJ
- del Hoyo Martínez, Carmen (Spain) University of Salamanca (Spain)
- hodrob, rami (Germany) Arab American University-Jenin
- kadry, seifedine (Lebanon) Beirut Arab University
- de la Torre, Luis (Spain) UNED
- Álvarez, Ainhoa (Spain) University of the Basque Country UPV/EHU
- Álvarez, Francisco (Mexico) Universidad Autónoma de Aguascalientes
- Álvarez, Pedro (Spain) University of Zaragoza

