PAEE 2014

INTERNATIONAL SYMPOSIUM ON PROJECT APPROACHES IN ENGINEERING EDUCATION

Innovation for Transformation

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28-29 July 2014
Universidad Pontificia Bolivariana, Medellín, Colombia

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PROJECT
APPROACHES
IN ENGINEERING
EDUCATION

TITLE

International Symposium on Project Approaches in Engineering Education
Volume 4 (2014) ISSN 2183-1378

Proceedings of the Sixth International Symposium on Project Approaches in Engineering Education (PAEE'2014)

Medellin, Colombia – 28-29 July 2014

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Department of Production and Systems - PAEE association
School of Engineering of University of Minho

Research Centre in Education (CiEd)
University of Minho

GRAPHIC DESIGN

Gen – Comunicação Visual

ISSN

2183-1378

This is a digital edition.

Welcome to PAEE'2014

We welcome you to the sixth International Symposium on Project Approaches in Engineering Education, organised at Universidad Pontificia Bolivariana in Medellin, Colombia. The PAEE organization is delighted to be hosted by a South American university for the second time. The theme of this year is Innovation for Transformation, aiming at the innovations in teaching and learning, needed to prepare engineering students for a changing world. Engineering education faces a need for transformation for several reasons. Apart from a diminishing interest in many industrialised countries, there is also a sense that students entering an engineering programme lack basic skills and motivation to finish an the engineering degree successfully and that engineers are not prepared in the best possible way for a changing business environment. Todays' engineers are facing complex challenges that require interaction with different engineering and non-engineering groups, involving complex systems. Traditional engineering curricula are not fully prepared for that, whereas project approaches to engineering education are considered to help students develop transversal and technical competencies that prepare in a much better way for the challenges they are facing. We hope that the sixth PAEE symposium provides a platform for sharing relevant experiences and useful tools, contributing to debates and discussions on the why and how of project-based learning, for both engineering teachers, educational researchers and others involved with training and education of future generations of engineers.

The Department of Production and Systems of the University of Minho, the Curriculum Development Working Group of the European Society for Engineering Education (SEFI), and the Ibero-American Association of Institutes of Engineering Education (ASIBEI) aim to join teachers, researchers on Engineering Education, deans, students of Engineering Schools and professionals concerned with Engineering Education, to enhance active learning approaches in Engineering Education through workshops and discussion of current practice and research. We are most grateful to Universidad Pontificia Bolivariana for hosting this sixth edition and we wish you all a fruitful symposium.

On behalf of the PAEE'2014 Organising Committee,

NATASCHA VAN HATTUM-JANSSEN

RUI M. LIMA

DINIS CARVALHO

ASIBEI Welcome Note

Palabras de Bienvenida PAEE'2014 por parte de ASIBEI

El tema que se desarrollará este año en la reunión PAEE'2014 ***"Innovación para la transformación"*** en la Universidad Pontificia Bolivariana, de la ciudad de Medellín, los días 28 y 29 de julio de 2014, es una excelente ocasión para abordar este temática de continuo trabajo en las distintas facultades de ingeniería de la Región Iberoamericana. Desde posturas en las cuales se atribuye sólo a la educación de posgrado las posibilidades de innovar atada a una investigación a profundidad y, por otro lado, en donde en el pregrado se trabaja la investigación de una forma estrictamente formativa. Por supuesto, temas y planteamientos como estos serán, seguramente, aspectos para discutir y desarrollar con la mayor rigurosidad.

Conscientes de este tema tan importante, la Asociación Iberoamericana de Instituciones de Enseñanza de la Ingeniería –ASIBEI- ha definido en su actual Plan Estratégico, como uno de sus ejes de acción, el de la **Innovación y el Desarrollo Tecnológico**, con el cual se permitirá aportar mejoras en la competitividad y en la incorporación de contenido local de conocimiento en las actividades productivas, en particular, en las Pymes de la región, mejorando la eficiencia en la utilización de los recursos existentes, con manejo sostenible y amigable con el ambiente, con importante impacto en el nivel de empleo, la calidad del mismo y una manera más equitativa en la distribución del ingreso.

La Asociación Iberoamericana de Instituciones de Enseñanza de la Ingeniería – **ASIBEI** – ha seguido manteniendo una alianza estratégica con PAEE (Project Approaches in Engineering Education) convencidos que estas sinergias son importantes para el presente y futuro desarrollo de nuestros países. Por lo tanto, todo esfuerzo que se haga en esa dirección, será fundamental para alcanzar el bienestar de nuestras sociedades, ya que ellas requieren de una ingeniería suficientemente robusta para procurar unas mejores y dignas condiciones de vida. Un ejercicio profesional que satisfaga esas expectativas debe estar construido sobre un conjunto de supuestos curriculares, responsabilidad de las instituciones de educación en ingeniería, que orienten a los estudiantes en la fundamentación científica – tecnológica- social, en el diálogo con sus pares en el mundo y en el desarrollo de habilidades para ofrecer alternativas plausibles de solución que permitan enfrentar exitosamente los problemas reales de la sociedad.

ASIBEI augura los mejores éxitos en el cumplimiento de los objetivos propuestos y desea destacar la organización y liderazgo desplegado por el equipo organizador adscrito al Centro de Investigación en Educación del Instituto de Educación de la Universidad de Minho, Portugal.

Con sentimientos de consideración y aprecio,

JAIME SALAZAR CONTRERAS

Secretario Ejecutivo ASIBEI

www.asibei.net

Julio de 2014

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PAEE'2014 Programme

28 July		
8h30	Registration	
9h00	Opening	Aula multipropósito
9h30	Ivan E. Esparragoza Latin American and Caribbean Journal of Engineering Education (LCJEE) The Pennsylvania State University	Aula multipropósito
11h00	Coffee break	
11h30	Student sessions	Aula multipropósito
13h00	Lunch	
14h30	Workshop A1 - Holistic competency development with Lean Engineering Education	Room 501
	Workshop A2 - Planning a PBL experience using Project Management concepts	Room 502
16h00	Coffee break	
16h30	Paper Sessions A1, A2, A3, A4	Rooms 501, 502, 504, 505
18h00	Free Time	
19h00	Transfer to Restaurant	
20h00	Symposium Dinner	

29 July

8h30	**Registration**	
9h30	**Bettina Dahl Soendergaard** UNESCO Chair in Problem Based Learning in Enginnering Aalborg University (Denmark)	**Aula multipropósito**
11h00	**Coffee break**	
11h30	**Industry panel**	**Aula multipropósito**
13h00	**Lunch**	
14h30	**Workshop B1 - Engineering Education for Sustainability**	**Room 501**
	Debate Session DB1: Student Assessment	**Room 502**
16h00	**Coffee break**	
16h30	**Paper Sessions B1, B2, B3**	**Rooms 501, 502, 504**
	Debate Session DB2: Active Learning Experiences	**Room 505**
18h00	**Closing session**	**Aula multipropósito**

PAEE'2014 Paper Sessions / List of Papers

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		16	Octavio Mattasoglio Neto - Octavio Mattasoglio Neto and Gabriela Pinto, The theoretical framework in papers about project and problem based learning used by researchers in Brazil
		28	Carlos Ynoguti - Artur Henrique G. C. Alves, Daniel Sader Pontello Neves, Pedro Julio Matuck and Carlos Ynoguti, Enhancing Computer Engineering Courses with Game Development
		55	Ciliana R. Colombo and Francisco Moreira - Ciliana R. Colombo, Anabela C. Alves, Natascha van Hattum-Janssen and Francisco Moreira, Active learning based sustainability education: a case study
		65	David Gomez - David Gomez, Mateo Castro, Margarita Ramírez Carmona, Leidy Rendón Castrillón and Carlos Ocampo Lopez, PBL Methodology Applied for the Development of a Software for Optimizing Bioprocesses Scaling
A2 Monday 28 July 16h30-18h00 Portuguese	502 Otilia Heinig	4	Otilia Heinig, Thais Schlichting and Jéssica Reinert - Adriana Fischer, Otilia Lizete De Oliveira Martins Heinig, Thais De Souza Schlichting and Jéssica Reinert, Práticas de letramento acadêmico no 4º ano do MIEGI (Portugal): evoluções nos usos da oralidade e da escrita no trabalho baseado em projetos
		23	Marco Pereira - Mayara Bortoti and Marco Pereira, Estudo de caso: Efeito da mudança do líder em um projeto de ABPj em uma turma ingressante de engenharia
		25	Martha Rodrigues - Márcia Zindel, Martha Veras, Marcelo Quirino and João Melo Silva, Programa de Desenvolvimento de Competências em Ambientes de Aprendizagem Baseada em Projetos, no Curso de Engenharia de Produção da Universidade de Brasília-Brasil, segundo o Modelo de Navegação Profissional de Le Boterf
		26	Marco Pereira - Carolaine G. L. Dos Santos and Marco Antônio C. Pereira, Estudo de Caso em Aprendizagem Baseada em Projetos : um catalisador para o desenvolvimento de competências transversais
		48	Natascha van Hattum-Janssen and Anabela C. Alves - Jossemar de Matos Theisen, Anabela Carvalho Alves and Natascha van Hattum-Janssen, Practices of Reading and Writing at Work in Teams in Project-Based Learning
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		34	Octavio Mattasoglio Neto - Octavio Mattasoglio Neto, Flávio D'angelo Pereira Da Silva, Antonio Carlos Dantas Cabral and Jorge Kawamura, A implantação de uma experiência de Project Based Learning num curso de Engenharia de Produção
		42	- Renan Aires, Afrânio Araújo and Luciano Ferreira, A Mobilidade Discente Interinstitucional: Uma Análise Situacional das Universidades Novas Brasileiras
		58	- Humberto Abdalla Junior, Luiz Molinaro, Daniela Garrossini, Ana Carolina Kalume Maranhão and Dianne Viana, Applying PBL to Teach Elementary Electrical Circuit Analysis
		67	Marinez Cargnin-Stieler - Marinez Cargnin-Stieler, Rui M. Lima, Anabela Alves and Marcelo C. M. Teixeira, The importance of teamwork in the case of an interdisciplinary team of teachers from the first year of an engineering course
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		44	Mario Vazquez - Claudio Cameselle, Mario Vazquez and Susana Gouveia, Prácticas en empresa y proyecto fin de máster. Elementos claves en la formación de los alumnos.
		46	Osvaldo Cano-Torres - Osvaldo Cano-Torres, Procesos Educativos y Formativos en la Escuela de Ingenierías de la Universidad Pontificia Bolivariana
		57	Jorge Flores - Jorge Flores, Las Creencias Epistemológicas de los Estudiantes de Ingeniería y el Aprendizaje Basado en Problemas

Session	Room / chair	#	Presenter - Authors, Title
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		56	Anabela C. Alves - Anabela C. Alves, Rui M. Sousa, José Dinis-Carvalho, Rui M. Lima, Francisco Moreira, Celina P. Leão, Laura C. Maia, Diana Mesquita and Sandra Fernandes, Final year Lean projects: advantages for students, university and companies
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		19	Martha Rodrigues - Martha Rodrigues, Márcia Zindel, Evaldo Cesar Cavalcante Rodrigues and Marcelo Quirino, Uma experiência da Universidade de Brasília - UnB. Disciplina ministrada em semestre anterior prepara para a abordagem baseada em Projeto
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		37	Leonardo Mesquita - Leonardo Mesquita, Marco Aurélio Alvarenga Monteiro, José Marcelo Wendling and Galeno Sena, Estudo do Processo da Motivação em Estudantes de Ensino Médio quando Envolvidos em Estratégias de Resolução de Problemas
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		60	Jorge Eduardo Calpa Oliva - Jorge Eduardo Calpa Oliva and Mariluz Osorio, Diseño de un curso con actividades de aprendizaje con enfoque en competencias sistémicas
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		11	Jimmy Gilberto Davila Velez - Jimmy Gilberto Davila Velez, La Red de Investigacion, Desarrollo y Divulgacion de los Procesos de Enseñanza- Aprendizaje a traves de la Ludica (IDDEAL), una Experiencia de Aprendizaje Activo en Colombia
		14	Jimmy Gilberto Davila Velez - Jimmy Gilberto Davila Velez, La Enseñanza de la Administración de Operaciones en los Programas de Ingeniería Industrial a Través de Actividades de Aprendizaje Activo con Enfoque Lúdico; una Experiencia desde el Currículo
		32	Carlos Ocampo Lopez - Montes-Gil Daniel, Lasso-Torres Laura, Ocampo-López Carlos, Ramírez-Carmona Margarita and Muñoz-Blandón Oscar, Aprendizaje basado en Problemas para los Cursos de Métodos Numéricos en Ingeniería: Modelamiento de un Sistema Enzimático Multivariable
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		32	Daniel Montes-Gil and Laura Lasso-Torres - Montes-Gil Daniel, Lasso-Torres Laura, Ocampo-López Carlos, Ramírez-Carmona Margarita and Muñoz-Blandón Oscar. , Aprendizaje basado en Problemas para los Cursos de Métodos Numéricos en Ingeniería: Modelamiento de un Sistema Enzimático Multivariable
		39	Sérgio Vicente - Sérgio Vicente, Edgar Mattarredona and Anabela Alves, The Importance of Blog as a Communication Tool to Support the Development of Project-Based Learning
		45	Sérgio Vicente, Dalila Romano and Vera Sá - Sérgio Vicente, Dalila Romano, Vera Sá and Rui M. Lima, The Influence of Peer Assessment to the Teamwork Dynamics in Project-Based Learning
		51	Jorge Jiménez-Llanos - Oscar Vasco-Echeverri, Jorge Jiménez-Llanos, Federico Isaza-Pérez, Andrea Hernández-Bedoya and Melisa Arango-Muñoz, Pneumatic Conveyor System Design for Organic Wastes in the Universidad Pontificia Bolivariana of Medellín
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Invited Speakers

PAEE'2014 attracted renowned keynote speakers, who are experts at Engineering Education in general and Project Approaches in particular, We are honoured to have the following inspiring keynote speakers: **Ivan Esparragoza** (Pennsylvania State University, USA) and **Bettina Dahl Søndergaard** (Aalborg University, Denmark). Their ideas will most certainly inspire all of us in our teaching practice and research on teaching and learning through projects.

Ivan Esparragoza - Pennsylvania State University, USA

Theme: *Global Design Projects: A Project-Based Approach to Educate World-Class Engineers*

Short bio

Dr. Ivan Esparragoza is an Associate Professor of Engineering and the Director of Engineering Technology and Commonwealth Engineering at the Pennsylvania State University (USA). He received a bachelor degree in Mechanical Engineering from Universidad del Norte in Colombia and a master and PhD in Mechanical Engineering from Florida International University in Miami, FL. His research interests are in engineering design education; innovative, sustainable and global design; and global engineering education. He has had the opportunity to work on engineering education initiatives with different institutions in Latin America and the Caribbean. He has been part of three different initiatives supported by NSF to bring together educators for the Americas to discuss issues in engineering education of interest for the region. He has introduced multinational design projects in a freshman introductory engineering design course in collaboration with institutions in Latin America and the Caribbean as part of his effort to contribute to the formation of world class engineers for the Americas. He is currently involved in several projects related to engineering education including the development of a modular assessment framework for professional skills using a model of domain learning approach and the development of assessment instruments for global collaborative design projects in cooperation with colleagues in the US, Colombia and Chile. His excellence in engineering education has been recognized locally and internationally. Dr. Esparragoza received two prestigious teaching awards at Penn State University and he received also the International Engineering Educator Honoris Causa "Ing.Paed.IGIP.h.c." title from the International Society for Engineering Education (IGIP) in Austria. Dr Esparragoza is recognized leader in engineering education worldwide. He is actively involved in several international engineering education organizations. He is member of the board of the International Division of the American Society for Engineering Education (ASEE). He is also member of the Latin American and Caribbean Consortium of Engineering Institutions (LACCEI) where he has occupied different positions including VP for Region I (North America), VP of Research and currently VP for Meetings and Associate Executive Director. Additionally, he is member of the Executive Committee of the International Federation of Engineering Education Societies (IFEES) as VP for the Americas and First VP. Dr. Esparragoza is the co-founder and current Editor-in-Chief of the Latin American and Caribbean Journal of Engineering Education (LCJEE).

Bettina Dahl Søndergaard - Aalborg University (Denmark)

Theme: *How to assess knowledge, skills and competencies in engineering projects?*

Short bio

Bettina Dahl Søndergaard is an associate professor at the UNESCO Chair in Problem Based Learning in Engineering Education at Aalborg University (Denmark). She has a M.Sc. degree in mathematics from Aalborg University as well as a M.Sc. degree in Educational Research Methodology from University of Oxford (UK). Her Ph.D. is in mathematics education from Roskilde University (Denmark). Since her Ph.D. she has worked as Adviser at the Norwegian University of Science and Technology among other things participating in developing the national tests in mathematics and informal mathematics for students. She has also worked as an assistant

professor at Virginia Tech (Virginia Polytechnic Institute and State University) where she taught and managed the secondary mathematics master education program for future teachers and participated in an out-of-school time program to increase learning and interest in STEM (science, technology, engineering, mathematics) for youth. Later she returned to Denmark to work as assistant/associate professor at Aarhus University. There she went into more higher education research and teaching in mathematics and science as well as teaching and developing workshops for informal STEM education for youth. During her stay at Aarhus University, she was also a Visiting Scholar at Stanford University with the H-STAR (Human-Sciences and Technologies Advanced Research) Institute. Research interests are assessment, particularly diagnostic testing, grading scales, and assessment in a PBL environment. She has also done a lot of research in conceptual understanding, and the application and teaching of mathematics to engineering students, and on how to do a good lecture at university. Further areas of interest are STEM learning in information settings, gifted students and transition issues from secondary to higher education. She is currently on the International Committee and Treasurer for the International Group for the Psychology of Mathematics Education (PME) and a vice chair of the Ministerial corps of external examiners for mathematics at the Danish universities. She is also the former chair of the Out-of-School-Time Special Interest Group of the American Educational Research Association (AERA).

Workshops

An important feature of the PAEE Symposium is the extensive workshop programme. Projects approaches to learning are usually aimed at the increase of student involvement in learning, therefore, a symposium on project approaches like PAEE'2014 count on active involvement of its participants. Three different workshops are scheduled, meant to enable the enhancement of project practice and the reflection on practice.

Workshop 1 - Introduction to holistic competency development with Lean Engineering Education

Anabela C. Alves, University of Minho - Portugal; Franz-Josef Kahlen, University of Cape Town - South Africa and Shannon Flumerfelt, Oakland University, Michigan, USA

While engineering content in general typically has a sound foundation in engineering graduates, competencies usually are much less developed. Concerns raised by engineering graduates as well as entry-level hiring managers always address deficiencies in systems thinking, critical analysis, sustainability and ethical issues, assessment challenges of the overall performance of a machine as opposed to the detailed functions of a component, as well as establishing criteria for, and transparency of decision making. This workshop addresses the above deficiencies from a holistic perspective, accounting for issues in communications, teamwork across discipline and geographic boarders, and project / design status visualization. Lean Engineering Education (LEE) is presented as this holistic perspective and as curricular innovation capable of develop the competencies missing in the current engineering curricula.

Workshop 2 - Planning a PBL experience using Project Management concepts

Rui M. Lima; University of Minho – Portugal and Andromeda Menezes, Federal Institute of Espirito Santo - Brazil

Planning and developing a project-based learning (PBL) process is a unique experience involving teams of students and teachers during a semester. This workshop objective is to reflect on some project management principles, and apply planning tools for improvement of PBL processes.

Workshop 3 – Engineering Education for Sustainability

Francisco Moreira, University of Minho – Portugal; Anabela C. Alves, University of Minho – Portugal; Ciliana Regina Colombo, Federal University of Rio Grande do Norte – Brazil; Natascha van Hattum-Janssen, Saxion University of Applied Sciences, the Netherlands

This workshop aims to discuss and reflect on engineering education for sustainable development bearing in mind the important role of engineers in shaping modern and sustainable societies. Alternative strategies to foster education for sustainability will be put forward, aiming at structuring the process and acknowledge feasible learning methodologies for the effective application of one such strategy.

Industry Panel

Innovate to Transform Education Models Incorporating Regional Capabilities to Impact the Industry

Marcela Montoya-Echeverri, Margarita Ramírez-Carmona, Carlos Ocampo-López, Jorge E. López-Rendón - Universidad Pontificia Bolivariana, Medellin, Colombia

The orientation of teaching and research to solve real industry problems, in which students can contribute by a balance between the rigor of science and practical application of knowledge, begins to become a reality in the Colombian classrooms. Engineering faculties have been implementing problem-based learning methodologies, supported by an integrated project or capstone project, and the presence of research in basic science in which are integrated the CDIO strategy or making an approach to the TEAL methodology (Technology-Enhanced Active Learning), originally conceived in the Massachusetts Institute of Technology (MIT).

In parallel, Antioquia has been working on integrating the capabilities of universities, technological development centers, companies and the state to create a regional model for technology commercialization. This initiative intends strengthen the innovation ecosystem and contribute to close the gaps between the University and the Industry from the transfer of the research results of knowledge-generating institutions.

With the synergy between education-based learning methodologies mentioned above and the implementation of a regional model for technology commercialization, focused mainly in University results, it is expected and increasing to generate valuable intellectual products eligible for protection and industrial implementation. Same time, it contributes to the quality and relevance of engineering education, creating favorable conditions for the transfer of results generated from academia to industry and increasing the competitiveness of the region.

Understanding the productive sector interest and their vision to short, medium and long term, as well as their growth strategies will enable academic and official sectors orienting programs to facilitate economic growth of businesses and consequently social empowerment and economic development of the region. Moreover, knowledge of the capacities, relationships and definitions existing strengths in the academic sector, the production sector, will provide companies the definition of academic-partners in innovation actors and the strengthening of links along term based on mutual trust. In the end, products of innovation will be generated with the assistance of the public sector as a facilitator of the process.

Speakers: Marcela Montoya-Echeverri, Carlos Ocampo-López, Jorge E. López-Rendón

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