

# I EELISA INTERNATIONAL CONFERENCE

BECOMING THE ENGINE THAT LEADS TO A NEW FUTURE

# BOOKLETS OF ABSTRACTS

National University of Science and Technology Politehnica Bucharest  
4 - 6 October, 2023



# Abstracts presentation programme

All the sessions will take place in Eastern European Summer Time (CEST+1 / UTC+3)

**Day 2**

**5th October, 2023**

11:30 - 13:00  
Aula Conference Centre - Room 2.1

EELISA Communities - Showcasing how education, research, innovation and society connect

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Innovative pedagogies mushrooming at alliance level: key examples from EELISA

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Innovative pedagogies for Engineering Education

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# 5th October, 2023


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11:30 -13:00

**EELISA Communities - Showcasing how education, research, innovation and society connect**

**Chair of the session: Zoltán Dubécsi** (Secretary General, Hungarian Rectors' Conference)

📍 **Aula Conference Centre - Room 2.1**

- P.3** • An inclusive project: join our mission to revolutionize home energy efficiency by **Patricia Aguilera Benito (UPM)**
  - P.6** • EELISA ESCE Community. Considering the societal impact of innovation by **Sergio D'Antonio Maceriras (UPM)**
  - P.9** • Inquiring into the footprint of EELISA activities by **Javier García Martín (UPM)**
  - P.11** • Where sustainability and happiness coexist: a science mapping analysis by **Jaime González-Masip (UPM)**
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## AN INCLUSIVE PROJECT: JOIN OUR MISSION TO REVOLUTIONIZE HOME ENERGY EFFICIENCY

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**Conference Topic:** Gender Equality, Diversity and Inclusion.

**Key words:** Service-learning; inclusive education; social action: active learning; energy poverty.

### ABSTRACT

The Service Learning project is an educational methodology that combines the academic learning with the community service. This project has been made thanks to the merger of the Escuela Técnica Superior de Edificación of Madrid and the Down Madrid Foundation with students from FOCUS LABORA program. The academic objective has consisted in the acquisition of knowledge about energy efficiency in order to create a guide about energy saving in our buildings. In this way, we can help people to improve their social insertion, to have a better life quality or reduce the energy poverty which lots of families suffer.

The methodology employed in the project development consists of two activities which have been made at the same time in the Installations Classroom from ETSEM, collaborative group classes and some pedagogical activities in order to encourage the inclusion of people with disabilities. Previously the beginning of the project, all the students from the ETSEM who will be involve in the project voluntarily, had received a sensitizing talk where they could express their afraid or worries about working with people with disabilities.





In the first activity, students learnt actions related to the social comfort of those families which suffer energy poverty. For the activity development the students made groups set up ETSEM and FOCUS students. Firstly, a class was given by the teachers about a topic related to energy efficiency. Next, the different groups of students had to develop the activity with that knowledge which has been taught. The project could count on, moreover, with the participation of enterprises like the Consejo General de Arquitectura Técnica and Wavin, a supplier of innovative solutions for the construction industry.

In the second activity, students who had coursed the installations subject participated with the objective of explaining the different topics related to the building installation to the FOCUS LABORA students. In these activities have been used resources in order to revitalize the classes and establish concepts. For instance, kahoots, online questionnaires, gymkhanas or escape room.

The project finished with the creation of a Good Practice Guide with the propose of helping people to save energy at their homes. The next step would be to spread it, therefore the next results which are mentioned below are hypothetical.

The ETSEM students have learnt mutually since they have worked in groups with classmates with different perspectives, so they learnt to appreciate the diversity and to develop their empathy and respect. These students, moreover, have assumed a leadership role. Consequently, the have developed their communication and educational skills.

The FOCUS students have had an approach to the university world; therefore, they have developed their social skills which will allow them to get on better in the future. They have also reinforced their self esteem thanks to the inclusion because they have felt that their contribution has helped. The teachers have dealt with the challenge of adapting the contents and manage communication enough simple in order to all the students understand everything. They have also faced to the high demand of attention that the students with disabilities need.

In relation to the university community, the implementation of this project promotes the values like equality, respect, and tolerance, creating an atmosphere for the learning and coexistence.

Furthermore, the inclusive education promotes the construction of a more inclusive society for the future.

From this initiative, Down Madrid Foundation and the UPM with this service learning project “Nos movemos por la pobreza energética” is clearly related to the Sustainable Development Goals (SDG) of the 2030 Agenda. The principal objective was covering the SDG 7 “Ensure access to affordable, reliable sustainable and modern energy for all”, adding our contribution with the good practice guide. Other SDG have been addressed, especially SDG 10 for inequality reduction, with the compromise of improve factors as students with disabilities integration and the support services of this group, and provide access programs for people with disabilities. The SDG 4 is also addressed which is about the quality education and the SDG 12 for the responsible consume and production.



After the first months, the foundation and the university make a positive balance of the project.

The participation was so high, in each activity there were between 20 and 30 students from the ETSEM and 10 FOCUS students. We are progressing in an education with qualified professionals, and at the same time, critical people who can start equitable coexistence models. Diversity as an opportunity of development and learning in classrooms.



**EELISA ESCE Community.**  
**Considering the societal impact of innovation**

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**Conference Topic:** Impact for society; Engineering education; Building sustainable cooperation

**Key words:** social impact; innovative teaching; SDG; interdisciplinary; ethics; social commitment



## ABSTRACT

The ambition of EELISA is to develop a common European engineer profile rooted in society, with increased inclusiveness, cross-disciplinarity, and commitment. Among other things, this includes environmental, social, and multicultural aspects to address the new challenges of a global society. Focusing on that, a group of professors and researchers from UPM with a shared commitment to the Social, Legal and Ethical aspects of technologies created the community Ethics, Social Commitment and Entrepreneurship<sup>1</sup>. The organization of different activities gave the opportunity to meet new colleagues who share the same commitment, and to start new collaborations with other communities in Spain and abroad that made possible to offer a wide range of activities that are increasingly interrelated with each other. Three of them are the following:

- 1. Summer Course:** *“Artificial Intelligence, Ethics and Human Rights”* A five days on site course in June 2022, co-organized with FAU University which was held at the Technical University of Madrid (UPM). 23 participants engaged with the objective to develop awareness of the risks and opportunities of Artificial Intelligence development; to gain knowledge around the ethical principles, professional practices and human rights orientations surrounding AI and to learn ethical analysis through practical development cases (hackathon, world café and other active methodologies were useful for this). Strong participation of academia (Jessica Morley from Oxford Internet Institute as an example); industry (Thoughtworks); and non-governmental organizations (IRIGHTS Lab).
- 2. Doctoral workshops and colloquia on the topic:** *“Integrating ethics, human rights and social impact analysis in your Artificial Intelligence research”*, where scholars from UPM, FAU, ITU And Scuola Normale Sant’Anna proposed a series of blended (on-line and on-site) hands-on seminars for students and early-stage researchers that are currently researching technologies and applications in the domain of Artificial Intelligence. This series of seminars provided a space for students to communicate their research and jointly with peer and experienced researchers, analyze the potential ethical, human rights and social risks and opportunities. Researchers could attend both technical and non-technical keynote lectures and coaching circles to analyze and improve fairness, transparency, explainability, security, safety, privacy, user autonomy and other ethical issues that may arise in the application of AI technology.
- 3. Social Science Garage.** *“Emergency workshop for engineers”*. A two-day hands-on workshop that took place in Madrid in March 2023. The purpose of this workshop-garage was to improve participants’ skills in thinking holistically and critically about the development of engineering projects that contribute to the SDGs. To meet those goals, the workshop started emphasizing the fact that engineers, anthropologists and/or political scientists see the same fact very differently.

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<sup>1</sup> <https://blogs.upm.es/eelisa-ethicssocialentrepreneurship/>



From there, after some brief theoretical talks, participants explore these differences facing the challenges of thinking their projects using critically the concepts of “impact”, “gender”, “equality” and “diversity and inclusion”, among others. The final goal was to increase awareness about the challenges that we, as humanity, are facing nowadays, and how to approach them holistically from an engineering standpoint.

As a result of these activities, we have detected a growing awareness around the importance of ethical and social impact of technology among students and professors at graduate and post graduate level. Nevertheless, there is a lack of understanding on how to integrate social and ethical concerns of new technologies through practical tools and methodologies, not only after but from the very early stages of the design. There are many efforts coming from research groups, innovative teaching groups, industry, public institutions, but they are not aligned, are fragmented and are not coherent.

Today's society demands from the engineer not only his work as a professional, but also as a responsible citizen. More than ever before, impact and risk management of scientific research and technology innovations is becoming a critical capacity for all stakeholders involved, and specially for scientific and engineering professions since new discoveries and inventions are rapidly propagated and scaled.

For this reason, we believe that ethics, human rights and governance aspects of technology innovation should be included and strongly reinforced in the training of today's engineers. Not only because it is the right thing to do, but also for two very practical reasons. On the one hand, the challenges that lie ahead are too wide to be faced from an exclusively technical or economic perspective. On the other hand, social risks, and the opportunities to improve our society with new technologies also represent economic risks and opportunities for all in the long term.

We would like to share these experiences with other communities of EELISA and encourage them to include the ethical and societal perspective in their own activities. The future of these activities in the second EELISA will be to consolidate the communities, and the activities, making joint official collaborations in the form of courses, PhD joint initiatives and research projects.





## INQUIRING INTO THE FOOTPRINT OF EELISA ACTIVITIES

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**Conference Topic:** Impact for society

**Key words:** Social impact, footprint, egalitarian society, service learning

### ABSTRACT

One of the objectives of the EELISA Alliance is to involve students in social challenges through their participation in activities. These activities are organized and developed by communities in which different universities of the alliance cooperate, with a strong international and inter-university character.

It is desirable that the development of activities produce a real impact on society, so that the university serves as a vehicle for transformation, both in its immediate environment and in major social challenges. However, EELISA activities must also produce a transformation within the university itself, strengthening ties with its environment, assuming a role with greater responsibilities and incorporating new visions into its academic activity. Finally, the impact must also be produced on people, teachers and students, acquiring new perspectives from teaching-learning activities, promoting awareness and change of attitude towards citizens.

Measuring the impact of EELISA activities is an outstanding challenge that will have to be addressed in order to strengthen the growth of the alliance. Currently, the impact reported on activities is a categorization of the “expected” effect of the activity, related to the “intent”, but it is necessary to have an approximation of the actual impact.



In this paper we propose to make a first inquiry into the footprint of the EELISA activities that we have carried out so far in our community **EGALITARIAN SOCIETIES: OPPORTUNITIES FOR EVERYONE**, without ruling out the incorporation of activities from other communities. This footprint will be analyzed at three levels: 1) in society, taking into account the social groups or environments for which the activity has been designed; 2) in students, reviewing their acquisition of skills and their reflections on values and social commitment; 3) at the participating universities, reviewing the impact of the implementation of the activities.

The proposed methodology consists of three phases. In the first one, a review of the published information of the EELISA activities carried out to date will be developed. This review will make it possible to classify the different activities, taking into account their goals, nature and characteristics. This will provide us with some parameters that may be of interest for measuring impact in later works.

In a second phase, the first inquiry of the impact that the activities developed in our community had on society will be carried out, especially in those that have worked side by side with vulnerable groups. Interviews and surveys will be used to perceive the footprint that participation in these activities has left on these groups, including the point of view of the different people involved. In this phase, it is worth highlighting activities such as: "We move against energy poverty" which tackles the problem of energy poverty in collaboration with the organization Down Madrid; "Elderly people as pedestrians" in which the difficulties of our elderly in the use of public spaces are analyzed, in collaboration with retirement homes; "Get active" in which we collaborate with the organization Proyecto Hombre to help in the therapy of young people with addiction problems; "Improving the Public Space of our Municipalities to the Challenges of the 21st Century" in which we visit small municipalities to plan improvements to public spaces in the face of climate change.

The footprint that each activity has left on the university students who have participated in it will be inquired in the third phase. For this purpose, the above-mentioned activities are very important, which involve students in tasks that have direct contact with society. Other activities of a more training and awareness-raising nature are equally important, such as the international workshops and hackathons organised by the community. In this case, collaborative work with students from other knowledge areas and other EELISA universities is the main vehicle for learning. Other types of activities to consider are those that have a profile of research, fieldwork and dissemination. Surveys will be conducted some time after activities have been completed, thus reducing the immediate emotional factor of the activity. These surveys will be aimed at capturing the students' own perception of how the activity has contributed to their training as engineers and citizens.

Finally, there will be a brief analysis of the scope that these activities have had in universities, their dissemination and knowledge by the university community, as well as their contribution to the general catalogue of EELISA activities. This analysis will serve to raise a series of reflections and doubts related to the participation of the teaching staff, the problems in the coordination of calendars or the integration of EELISA activities in the academic organization.



## WHERE SUSTAINABILITY AND HAPPINESS COEXIST: A SCIENCE MAPPING ANALYSIS

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**Conference Topic:** Impact for society.

**Key words:** bibliometric analysis, science mapping, happiness, corporate social responsibility, sustainability, stakeholder management.

### ABSTRACT

Happiness is an emotional state, subjective, and characterized by positive feelings and well-being in each individual. It derives from circumstances that do not necessarily correlate with income level or economic wealth (Easterlin, 2004; Easterlin et al., 2010). Due to this ambiguous relationship between money and happiness, it is of interest to analyze what other factors affect people's lives and condition their happiness (Easterlin et al., 2010; Onkila, 2015; Buijs et al., 2021).

Happiness is of interest to society, but also to companies, as it is another variable that affects productivity (Oswald et al., 2015). Thus, the study of happiness in business and social sciences has generated great interest and extensive academic production in the last decade, focusing on aspects such as marketing and how products can improve consumer happiness (Anderson et al., 2013), consumer behavior (Soscia, 2013), human resources and employee happiness, human capital, commitment and productivity (Zelenski et al., 2008; Onkila, 2015). On the other hand, new areas of happiness analysis appear such as corporate social responsibility (Chia, Kern and Neville, 2020) and sustainability (Sachs, 2016). The effects of economic activity on the environment, and the consequences on diversity or climate change, as well as social inequalities, are of concern to the population. These concerns influence the way people prioritize their social needs, their time and social relationships, and ultimately their level of happiness (Buijs et al., 2021).



In general, the search for a better quality of life leads people to change their values, their behaviors, and even to choose specific living and working places (McGregor and Goldsmith, 1998).

The stakeholder approach, CSR and sustainability are interesting theoretical frameworks to holistically analyze new issues in happiness research (Harrison and Wicks, 2013; Jones and Felps, 2013a, 2013b; Chia, Kern and Neville, 2020). There are reasons to think that a sustainability-friendly context generates happiness in stakeholders, and that happiness in people can generate the circumstances for favorably sustainable development (e.g., people might be more favorable to change if it increases their level of perceived happiness).

This paper aims to identify and analyze the scope and impact of research on happiness in the social sciences, looking for connections between happiness and CSR and sustainability, as well as defined thematic areas and trends in research on the topic. The methodology chosen is the bibliometric mapping analysis having as scope the concepts of CSR, sustainability and happiness in the Web of Science Social Science Citation Index. As results, different bibliometric performance data, thematic research clusters, strategic maps that qualify them and a diagram of their temporal evolution were obtained. The results indicate that social science research on human happiness has expanded in the last decade to include mainly aspects such as employee satisfaction, sustainable consumption, well-being, circular economy, sustainable tourism, environmental sustainability, sustainable development or territorial management.

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# 5th October, 2023


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14:00 -15:30

Innovative pedagogies mushrooming at alliance level: key examples from EELISA

Chair of the session: **Alfredo Soeiro (University of Porto)**

📍 **Central Library - Room 4.1**

- P.15** • Elevators pitch contest as a methodology of creativity and gamification in the learning of engineers through SDG challenges by **Juan José Morillas Guerrero (UPM)**
  - P.18** • Harnessing engagement and effectiveness in EELISA activities through game-based learning: examination of a workshop series by the circular EELISA community by **Aysegul Akcay Kavakoglu (ITÜ)**
  - P.21** • Research-based learning: learning, current status across EELISA, challenges, opportunities, and the path towards life-long learning by **Mehmet Akif Yazici (ITÜ)**
  - P.23** • The Learning Station Model: A New Approach for Transforming the Learning Landscape in Higher Education by **Merve Çalmli Akgün (ITÜ)**
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## **AEROENTREPRENEURSHIP 2022: Elevators pitch contest as a methodology of creativity and gamification in the learning of engineers through SDG challenges.**

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**Conference Topic:** Innovative pedagogies/Entrepreneurship and Innovation

**Key words:** educational innovation, entrepreneurship, SDGs, challenges, elevators pitch, engineering.

### **ABSTRACT**

The AEROEMPRENDE 2022 activity was born as an EELISA Community event dedicated to entrepreneurship and the SDGs. It was an original proposal that aimed to present a series of sustainable challenges to be solved by our students. It was designed by the Technical School of Aeronautical and Space Engineering (ETSIAE) with the help of the REFERENT (Engineering education for a sustainable world, based on IoT) research group as part of the activities accredited by EELISA. Several Schools from the Technical University of Madrid (UPM), Spain, and the Dragon Wings Students' Association also collaborated: Technical School of Telecommunication, Technical School of Mining and Energy Engineering, Technical School of Information Systems and Technical School of Computer Engineering. The activity was also part of the work plan for GAME (gamification and serious games as a means of improving entrepreneurial skills among UPM engineering students) educational innovation project (PIE22\_1401).



This was an event with an entrepreneurship spirit that also incorporated Pitching Competition for the teams with innovations, start-ups, and capable teams with creative intentions in the aerospace sector. The impacts on SDGs (4, 8, 9, 11 and 17) were worked on through the challenges posed. Specifically, they were developed following the methodology of “learning by doing”.

AEROEMPRENDE 2022 was held on 15 November 2022. The participants passed a previous workshop on design thinking given by Prof. Kontaxakis. Afterwards, they were randomly assigned a social and/or technological challenge related to three possible blocks (mobility, sustainability and environment and society and inclusion), so that they could respond to it by creating a viable business idea that they presented in a three-minute elevator pitch.

#### MOBILITY

- Challenge 1: Contribute to the rationalization and interconnection of public transport in large cities.
- Challenge 2: Explore new forms of sustainable mobility in smart cities to decrease pollution.
- Challenge 3: Achieve energy alternatives for the transport of the future that adapt to climate change.
- Challenge 4: Improve the safety of cyclists and skateboarders through applied technologies.

#### SUSTAINABILITY AND ENVIRONMENT

- Challenge 5: Improve methodologies and techniques to control energy consumption in housing.
- Challenge 6: Optimize water use through the application of automated control systems and aerospace technologies.
- Challenge 7: Find innovative uses for plastic residues and waste.

#### SOCIETY AND INCLUSION

- Challenge 8: Combat loneliness of the elderly by increasing interaction with new digital technologies.
- Challenge 9: Bring technological mechanisms to improve the eating habits of young UPM students.
- Challenge 10: Provide tools to raise awareness, reduce the gender gap, and increase attraction to technology among high school students to foster interest in STEM careers.
- Challenge 11: Propose IoT or similar resources that facilitate the experience of blind people in everyday shopping.
- Challenge 12: Investigate ways to increase the application of engineering to society to achieve greater diversity and inclusion.

Thirty-one students from the participating schools registered for the event, of which fifteen attended and presented their elevator pitches.

The program also included participation in a Seminar on Social and Technological Entrepreneurship. After the seminar, still in the morning session, the students were given time to prepare elevator pitches presentations. After lunch, the oral presentations took place, which



included the design of a prototype of the product they had devised. The jury was composed by the deputy director of the ETSIAE, a member of the Centre for Innovation in Technology for Human Development (itdUPM) and Prof. Morillas as organizer.

In the end, the winner was the team that designed a mobile software and IoT sensor system to help blind people locate objects in a supermarket and shop using a headset. The challenge they responded to was making everyday life easier for disabled, blind people. The solution also provided additional nutritional and allergen information in spoken form to make it easier for them to get information about the products.

This activity was a success because engineering students are not used to gamification activities as a learning methodology. Therefore, a competition of ideas through the defense of their proposals in an elevator pitch was a formative and motivating step forward. In addition, the students received a boost to their knowledge regarding SDGs and the work they will be able to develop as future engineers in order to solve social and environmental problems. We were able to verify this by means of a satisfaction survey in which the students themselves expressed very favorable opinions on the experience, that will be repeated this year again in the new INGEMPRENDE 2023 event.



# HARNESSING ENGAGEMENT AND EFFECTIVENESS IN EELISA ACTIVITIES THROUGH GAME-BASED LEARNING: EXAMINATION OF A WORKSHOP SERIES BY THE CIRCULAR EELISA COMMUNITY

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**Conference Topic:** Innovative pedagogies (primary), Engineering education (secondary)

**Key words:** Game-based learning, methodology assessment, sustainability education, CIRCULAR  
IN PLAY Project, Circular EELISA Community

## ABSTRACT

Game-based learning (GBL) has emerged as a powerful educational tool that leverages the inherent engagement and motivation offered by games to enhance learning outcomes (Plass et al., 2020).





One of the key benefits of GBL lies in its ability to captivate learners and foster a heightened sense of engagement and motivation; game-like environments are also effective in promoting active participation and sustained interest among learners. Games provide an immersive and interactive learning environment that facilitates the transfer of knowledge and skills to real-world contexts. The characteristics of online GBL in international higher education settings can vary depending on different factors, including the specific context, technology infrastructure, and educational goals. However, several common characteristics can be identified, such as (1) accessibility and flexibility, (2) multicultural and collaborative learning, (3) immersive and engaging experiences, (4) personalization and adaptivity, (5) real-world relevance and application, and (6) assessment and feedback mechanisms (Anastasiadis et al., 2018; Dicheva et al., 2015). Based on these features, this study investigates online GBL processes designed through the international and interdisciplinary collaboration of institutions of higher education in order to foster sustainability-driven attitudes and behavior among engineering students from around the world. More specifically, it examines gamification and serious game methods and their effectiveness in creating original GBL content during CIRCULAR IN PLAY, a project supported by the first EELISA Call for Joint inter-institutional Activities in Communities between September 2022 and March 2023. CIRCULAR IN PLAY was a venture of the Circular EELISA Community and a product of collaboration between İstanbul Teknik Üniversitesi (İTÜ), Universidad Politécnica de Madrid (UPM), Universitatea Politehnica din București (UPB), and Scuola Superiore Sant’Anna-Pisa (SSSA).

CIRCULAR IN PLAY comprised a series of three online GBL nights and subsequent design activities associated with international events celebrating innovation and environmental science. The primary aim of the project was to enhance participants’ awareness and knowledge of the circular economy and the accompanying socio-civic competencies in a GBL setting, while its secondary aims included enhancing knowledge about the EELISA Alliance and thus contributing to the participants’ education mobility. The first workshop, 3VIA 2022, was held on September 30th and used trivia activities regarding the three main themes of the circular economy: reduce, reuse, and recycle. Kahoot! was the primary platform for the gamification activity, and each theme was developed and delivered by a different university of the international organizing team in one main room for individual play. The second workshop, Scape Room, was held on November 18, 2022, and designed as a scientific parkour focused on the circular economy and socio-civic skills. The activities consisted of two serious games referred to as challenges: Pictionary and the Earth’s Defenders. Both challenges utilized smaller virtual rooms to conduct group work and Google Jamboard to draw and visualize ideas through collective brainstorming moderated by the participating university’s professors and researchers.

The final workshop, R-Express, was held on March 13, 2023. This workshop merged the gamification and serious game methods in a challenge entitled ‘Why? What? How? When?,’ in



which the participants first competed individually in short theme-based Kahoot! sessions and then engaged in groups in moderator-led incremental brainstorming over Jamboard. The principle target group of all the workshops was first- and second-year university students from the four participating countries and other EELISA Alliance member universities, whereas the audience involved both faculty and students at all levels of undergraduate and graduate study from the member universities as well as across and beyond Europe. In order to prepare the students for the GBL applications, in all workshops the challenges were preceded by short films and introductory presentations about sustainability and the circular economy and ice-breaker questions intended to emphasize the internationality of the audience. Each workshop earned the participants digital EELISA badges consisting of different SDGs and EELISA impact levels– a novel EELISA recognition framework that feeds into the GBL value of the project setting.

This study employs a qualitative analysis to examine CIRCULAR IN PLAY’s activities in terms of their GBL methodology. After the identification of the characteristics and criteria of GBL based on the relevant literature, the workshops will be analyzed according to their methods and outcomes to identify the GBL criteria linked to their characteristics. A comparative assessment will subsequently be made to reveal the engagement and efficiency of the outcomes of GBL in the EELISA workshops. The study will close with a critical discussion of how and with which strategies gamification and serious games were used as a learning method by the Circular EELISA Community and what kind of feedback emerged throughout the case evaluation.

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# **RESERCH-BASED LEARNING: CURRENT STATUS ACROSS EELISA, CHALLENGES, OPPORTUNITIES, AND THE PATH TOWARDS LIFE-LONG LEARNING**

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**Conference Topic:** Engineering education, Innovative pedagogies, The University of the future

**Key words:** Reserch-based learning, challenge-based learning, learning stations, life-long learning

## **ABSTRACT**

Research-based learning (RBL) is a paradigm of education where students/learners are exposed to a research problem in their field. Through this experience, learning is enabled as learners need to research many subjects, methods, and problems new to them. In this approach, teachers/educators act more like an enabler or a mentor rather than an instructor.

This paradigm has many similarities and overlapping qualities with other paradigms such as project-based learning, challenge-based learning, and service-based learning. EELISA work package 5 (WP5) is entitled “Link between Education, Research, and Innovation” which encompasses several tasks related to enabling joint research and education activities, as well as bringing these two together inside the classroom for the benefit of students. In the context of WP5, two RBL symposia have been held, the first in May 2022 in Istanbul, Türkiye, and the second in May 2023 in Pisa, Italy. Good practices of RBL across all EELISA institutions, as well as EELISA community activities involving RBL were introduced in these symposia. People involved in these activites, researchers/teachers and students alike, had the chance to come together and exchange their experiences.

The RBL activites observed in the EELISA institutions can be categorized with respect to their level (undergraduate or graduate), or their framing (curricular or extracurricular). Graduate level RBL activites are more aligned with thesis work and more organically linked to actual research carried out as the routine activity of professors serving as advisors. On the other hand, undergraduate RBL activites are observed mostly in extracurricular settings. We have observed that there is still a long way in front of educators and curriculum designers in terms of incorporating RBL into the standard practice of teaching.



One of the key observations is that professors by and large have no formal training on how to teach. Most of us rely on our own experiences from school and carry on with the traditional ways of lecturing. Innovative pedagogies such as RBL require, at a very elementary level, a basic understanding of learning objectives. This underlines a need for the train-the-trainer activities in the mid to long term.

A good way to induce learning is putting the learners in a position of teaching. This can be achieved in a number of ways. Among the examples presented in the RBL symposia, one activity was having undergraduate students design simple experiments for children. In this way, children observe science in action, while the undergraduate students are forced to grasp the subject in such a way that they can propose experiments to demonstrate elementary results in a given context. A similar activity is involving general public and having students present their work to them. It has been observed that people with very little knowledge on a subject can often ask questions that requires the students to have understood the subject in a very essential and elementary way. Exposure to external stakeholders such as industrial collaborators and governmental or non-governmental organizations is also crucial, as they provide a different perspective to academic research in terms of both timing and procedure, as well as being a source of real-life challenges that stimulate the interest of students.

Another way to put learners in a position of teaching is through the “learning stations” model. A learning station is a collection of activities ranging from reading to much more contemporary ways of learning such as games, field trips, listening to and/or preparing podcasts etc., to enable the learning of a subject, often in a modular way. In the ideal setting, students/learners prepare the learning stations, as opposed to the instructors. In this way, co-learning is achieved.

Going forward, RBL is an important concept which enables active learning by immersing the learners into the subject through research activities. This is especially significant in the context of sustainability as well as the next phase of EELISA, expected to commence very shortly. A life-long learning-oriented mentality is essential for the education of the engineer of the future. Learning how to learn is more significant than much of the content provided to the students of today in the traditional manner.



## The Learning Station Model: A New Approach for Transforming the Learning Landscape in Higher Education

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**Conference Topic:** Innovative pedagogies

**Keywords:** Active Learning, Learning Station Model, Higher Education Institutions, Stakeholder Engagement, Innovative Pedagogies





## ABSTRACT

The role of Higher Education Institutions (HEIs) unprecedentedly increased in the age of digital transformation, making a dilemma more visible than ever: The methods of teaching remain relatively stagnant, although the current HE ecosystem is far from meeting the expectations of young learners and benefiting from their creative potential and talent.

Transforming HE through innovative approaches has become a key objective to improve the quality of education. The need for learner-centered, modular, flexible, scalable instructional design approaches and appropriate learning experience design tools calls for the development of active learning (AL) environments in collaboration with internal and external stakeholders of the HEIs, including the alumns. There is a significant room for improvement regarding the quality of learning in the HE system by equipping students, academics and other relevant actors through an innovative outlook. Therefore, this paper introduces the Learning Station (LS) Model as an innovative approach to transform the learning landscape of HEIs into a modular and flexible AL environment. The essence of the LS model lies in the dynamic involvement and collaboration of both internal and external stakeholders with HEIs, and delegating the authority of learning to learners so that they can design their own learning experiences as part of their lifelong learning pathways. The LS model allows the active participation of stakeholders by taking different roles such as learners or learning experience designers amongst others, while encouraging them to work together in co-creative and multi-disciplinary learning environments through physical, digital, or hybrid formats.

The paper unfolds into three main sections: First is the conceptual underpinnings of the LS model, its modular configuration and advantages of using the model. Second is the empirical part which presents case examples from various fields from both formal learning and non-formal learning settings, where the LS model was implemented across different temporal dimensions and learner groups. Quantitative and qualitative data from around 150 participants who took part in the implementation of LS model by the ITU Centre for Excellence in Education (ITU CEE) and by academics at undergraduate<sup>1</sup> and graduate-level courses were summarized to illustrate how the proposed model led to learner satisfaction. The paper depicts how learner satisfaction is enhanced via LS model's acknowledgement of diverse forms of learning, while including active participation and interaction of learners. Final part discusses the future directions for the implementation of the LS model as an alternative innovative approach. Thus, promoting the creativity and talent of the learner, the LS model encourages affective perspectives in the fluidity of learning through introducing co-creative learning experiences. Since the LS model recognizes multiple forms of learning in the HE setting, the possible informal learning sequences gained in the unique and individual learning experiences pave the way for enhancing formal and non-formal learning<sup>2</sup> processes vital for life-long learning.

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<sup>1</sup> Acar, E. and Jones, B.İ. (2021) [Use of digital Learning Stations to promote active learning at undergraduate level: The case of building production systems in architecture education](#). AMPS proceedings series 23.1: Online education – Teaching in a time of change, Ed. Zaim Adil, pp.66-76.

<sup>2</sup> See the Council of Europe (last accessed on August 11, 2023).  
<https://www.coe.int/en/web/lang-migrants/formal-non-formal-and-informal-learning>



This perspective further aligns with the Digital Education Action Plan<sup>3</sup> (2021-2027) of the European Commission that embraces the aim to support the adaptation of the education and training systems to the digital age. In addition, the LS model overlaps with the European Skills Agenda<sup>4</sup>, which particularly emphasizes “initiative on individual learning accounts” as defined in Action 9, to ensure that people have the right to ‘skills for life’ in their lifelong learning pathways. The paper concludes with a discussion on particular challenges that constrain the introduction and implementation of innovative pedagogies in the learning landscape of HEIs.

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<sup>3</sup> The European Commission, Digital Education Action Plan (last accessed on August 11, 2023).  
[https://education.ec.europa.eu/focus-topics/digital-education/action-plan#:~:text=The%20Digital%20Education%20Action%20Plan%20\(2021%2D2027\)%20is%20a,States%20to%20the%20digital%20age.](https://education.ec.europa.eu/focus-topics/digital-education/action-plan#:~:text=The%20Digital%20Education%20Action%20Plan%20(2021%2D2027)%20is%20a,States%20to%20the%20digital%20age.)

<sup>4</sup> The European Commission, European Skills Agenda (Last accessed on August 11, 2023).  
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# 5th October, 2023

14:00 -15:30

Innovative pedagogies for Engineering Education

Chair of the session: Emrah Accar (ITÜ)

📍 Central Library - Room 4.1

- P.27** • Challenge-based learning in the Health in the City EELISA Community: key success factors and challenges by **Teresa Sánchez Chaparro (UPM)**
- P.30** • Involving students in EELISA community activities by offering an MSc optional course by **Tamas Lovas (BME)**
- P.32** • Think tank on Sustainable Buildings. European Space Agency - Sustainable BCC Community by **Sergio Vega Sánchez (UPM)**



## CHALLENGE-BASED LEARNING IN THE HEALTH IN THE CITY EELISA COMMUNITY: KEY SUCCESS FACTORS AND CHALLENGES

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**Conference Topic:** Engineering education

**Key words:** Challenge-based learning, health sector, engineering, interdisciplinary

### ABSTRACT

#### Introduction

The Health in the City community was created in 2021 as one of the pioneer EELISA communities. It was initiated by 44 UPM faculty members, from 8 different faculties as well as 16 industrial and public administration sponsors. The Health in the City community aims for healthier cities and citizens through the application of technology, processes and data analysis with an interdisciplinary approach in three main areas:

- Prevention & Development of inclusive, healthy contexts
- Humanized and efficient hospital care
- Digital health & Home care

Since its creation, the community has developed both formal and non-formal teaching and learning activities. The community has been particularly active in organizing challenge-based activities in which engineering students are confronted to real problems. These activities have been organized in cooperation with different challenge owners in the health sector: hospitals,



primary health centers, public administrations, certification authorities and private companies.

Up to the current moment, since the creation of the community, around 120 biomedical engineering students, 60 industrial engineering students and 4 architecture students have participated in challenge-based projects. The following contribution provides a description of the activities organized, while sharing key success factors and challenges.

### **Description of the activities**

The challenge-based activities were organized in the context of official teaching modules in four degrees:

- Bachelor and Master in biomedical engineering
- Bachelor in architecture
- Master of engineering management

In all cases, the students, working in small groups or individually, were proposed different challenges by the problem owners. In the case of the bachelor and master in biomedical engineering, students were confronted with a technological problem and had to design, implement and validate a technological solution. Some examples are focusing on medical images (i.e. the design and implementation of segmentation and reconstruction algorithms for thyroid and breast nodules or the design and implementation of a methodology for the analysis of white matter activation in [18F]FDG PET images of patients with Alzheimer's disease), medical training solutions (i.e. design and implementation of a neonatal clinical simulator for lung ultrasound assessment and management of pneumothorax and thoracic effusion), biomedical devices (i.e. design and manufacturing of haptic gloves for virtual reality based simulations) or mHealth solutions (design and development of an mobile application for monitoring the evolution of lumbar pain).

Students from the bachelor of architecture were confronted to different challenges related to the improvement of environmental conditions in several nursing homes in Madrid and hospitals. Some of the topics explored were the application of nature-based design to improve the wellbeing of patients with Alzheimer, or the implementation of measures to improve air quality around hospitals. Some interesting good examples have arisen in other European cities, so there is an interesting research line.

Finally, in the master of engineering management, students analyzed and proposed solutions to problems related to the improvement of processes and management methods in different health related organizations. Some examples are the development of balance-score cards, the application of lean healthcare methods to the optimization of spaces, and the reengineering of processes in view of the introduction of tele-medicine technology.



### Some key success factors and challenges

The following factors were important for the success of the challenge based initiatives:

- *Challenge owner approach*: in the three initiatives there was an initial investment of resources in order to gain mutual knowledge and establish a trust relationship with the challenge owner. The challenges were decided in close cooperation with the central management of the institutions with a view of creating great organizational impact and ensure sufficient support by the involved organizations.
- *Portfolio approach*: the initiatives working with the same challenge-owner were centrally coordinated. As a result of this, several synergies and complementarities were detected between the different initiatives, which amplified the impact created. This approach also enabled the detection of cross-learning opportunities.
- *Interdisciplinary cooperation*: although the three initiatives were independent, the professors coordinating the activities worked in a coordinated fashion. Technology problems that were being tackled by bio-medical engineers lead to process problems that were subsequently tackled by industrial engineers. In contrast, while going through the process reengineering cycle, industrial engineer students faced technology problems that were transferred to their bio-medical colleagues. In the case of the architecture challenges, the involved professors provided support on qualitative analysis and survey-based field-work methodologies.

A number of challenges remain that should be addressed in the future:

- *High amount of resources involved*: the involvement in real projects linked to actual interventions requires a great investment in time both for students and professors. Professors are also heavily invested in developing the challenge owner and portfolio approaches. As a consequence, it is difficult to scale up this kind of activities and to lead them to a massive scale.
- *Difficulties for internationalizing the activities*: working in a real setting and in the context of an official degree also makes it difficult to integrate international students in the experience.
- *Difficulties for engaging the students at the level required*: this kind of activities require an engagement of the students beyond “learning as usual”. Specific techniques and procedures must be put in place to achieve the intended depth of learning and engagement.
- *Difficulties for fulfilling a whole design-implementation cycle in one academic term/year*. It is necessary to establish a realistic approach to the problem and for this the students only have a few weeks, after which they have to start with the elaboration of the proposals. Some problems require indeed several academic cycles to arrive to a minimum viable solution and establishing the links between different groups of students working in the same problem is an additional challenge.





## INVOLVING STUDENTS IN EELISA COMMUNITY ACTIVITIES BY OFFERING AN MSC OPTIONAL COURSE

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**Conference Topic:** Engineering education; Innovative pedagogies

**Key words:** projectwork, non-technical skills, soft skills, short-term mobility

### ABSTRACT

A new course, European Engineering Projectwork has been launched in the spring semester of 2023 in English with 20 MSc students at the Faculty of Civil Engineering of BME.

A central element of EELISA is the support of student community activities. How do we motivate our students to participate in activities that broaden their horizons, develop both technical and other key competences and even have cultural values? One of BME's answers is to launch an optional course dedicated to community activities for MSc students.

The course is called European Engineering Projectwork; it was launched for the first time in the spring semester 2023, in English with 20 MSc students at the Faculty of Civil Engineering of BME. In the pilot semester, the course was only taken by civil engineering students with a background in building information modelling and management and the development of sensor networks for buildings. In the spring semester, another course of these students involves a one-week internship to build a smart house system, collect and analyze large amounts of data and perform BIM-based simulations. In this context, the EELISA optional course aims to develop a virtual product or service in a teamwork environment, which will require engineering and digital competences, as well as communication, social and entrepreneurial competences, among others. The course assignment will also be aligned with the Sustainable Development Goals (SDGs) and existing EELISA community activities.

In March and April, students will work on non-technical tasks supporting engineering activities, each based on a lecture by a BME professor, carried out in teams but mentored by BME lecturers:



- Study of project management methods and online interfaces. The selection of an environment per team, the definition of the project tasks and their continuous monitoring, the establishment of communication channels.
- Developing a business model and plan. Students will create a business plan, demonstrate how their idea can be marketed.
- Fundraising, investor communication. Students will learn how to get funding to realize their idea through the BME Z10 startup incubator programme.
- Develop presentation and communication skills. Presenting and communicating results and ideas is a key priority in a business environment, students will learn the basics from an expert.

In April, they will carry out an internship (in the frame of an other course, mandatory in their program) and in May they will work on engineering tasks, but document their activities in a way that supports their marketing objectives.

In June 24 BME students (including 6 Hungarians and 18 foreigners) participated in the SUSBCC-PEHK: PROPTech Entrepreneurship Hackathon in Madrid, organized by the Universidad Politécnica de Madrid (UPM) EELISA Sustainable Buildings, Cities and Communities community. The team of BME students was accompanied and mentored by two lecturers from BME, Tamás Lovas and Balázs Nagy, who supervised their activities at the hackathon.

On the first day, the students in 5 groups were introduced to different sustainability-related organizations, research and developments (e.g. a visit to UPM Solar Decathlon buildings, IoT and smart city research labs, and the European Space Agency's facility management office), which provided inspiration for the development of sustainability-related products that the teams worked on in the following days. All activities were led and supported by lectures from leading UPM trainers and professors. On the last day, the teams presented their results in 5-minute presentations, which were then awarded in a total of 8 categories by the organizers, sponsoring companies and EELISA. As BME had the largest student community, all teams included BME students.

Launching such course is an effective way to involve students in EELISA communities. From next spring we intend to offer this course on all faculties of BME that allows to create student teams in various fields, and hopefully it will be attractive to exchange students, too.



## THINK TANK ON SUSTAINABLE BUILDINGS. EUROPEAN SPACE AGENCY – SUSTAINABLE BCC COMMUNITY

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**Conference Topic:** Innovative pedagogies

**Key words:** Sustainability, think tank, challenge-based learning, collaborative work, Digitalisation, ESG

### ABSTRACT

The Think Tank on Sustainable Buildings was organized by the European Space Agency (European Space Astronomy Centre) and the EELISA Community SUSTAINABLE BCC (Sustainable Buildings, Cities, and Communities). It was an educational activity to promote innovation and generate fresh ideas to launch a comprehensive sustainable refurbishment of the European Space Agency (ESA) building “A” in Spain. It was a high impact activity consisting of a large think tank, with the participating students and the support of professors, researchers, and professionals, to undertake a comprehensive rehabilitation operation in the spirit of the New European Bauhaus and with the triple bottom line approach of sustainability (social, economic, and environmental).

The Think tank took place in a hybrid format in the last week of January 2023 at the ESA-ESAC headquarters in Villanueva de la Cañada (about 30 km from Madrid, Spain), but the scope of development covered the entire 2022-2023 academic year. We tried to move the students to the environment in which we all will be operating in the coming years: SUSTAINABLE, EFFICIENT & DIGITAL BUILDINGS.

This activity was a very good opportunity for students to acquire a global and integrative vision from the spirit of the New European Bauhaus and sustainability, gaining awareness and commitment to social, economic, energy, and environmental concerns, as well as discovering the potential offered by current digital trends to support and promote them from a perspective of efficiency.



The think tank was actually composed of 6 different think tanks (TT): 4 of them working in thematical parallel sessions from the three pillars of sustainability (HEALTH, WELLBEING & COMFORT; COMPREHENSIVE SUSTAINABILITY & ASSESSMENT; ENERGY EFFICIENCY; and EFFICIENT FACILITY MANAGEMENT & BUILDING OPERATION), 1 cross-cutting TT on digitalisation (DIGITAL SUPPORT), and 1 collective TT on integration through the New European Bauhaus Spirit (NEB INTEGRATION). In total 30 different and complementary thematic workshops were developed during the week.

The starting point were the Project Management methodology used and previous successful experience of the ERASMUS+ FMgoesDIGI project on digitalisation in Facility Management, applying the lessons learned from this activity.

The main challenge consisted of how to converge the more than a thousand ideas that were estimated to be generated into refined, filtered and agreed conclusions in each of the workshops, reaching conclusions that could be useful.

All the workshops lasted 2 hours and each one dealt in depth with a different topic, complementary to all the others. They were structured in a very specific and regular way, based on 4 processes:

- Documentation previously uploaded in a repository of moocs, videos, articles, material for people to consult beforehand in the form of a flipped classroom.
- Each workshop started with a 20' mini-masterclass that gave an overview of the topic, hierarchised the ideas, and solved the students' doubts. After that, one, two or three specific challenges were proposed to each of the participating groups (total 30').
- In the group work, a Brainstorming session was held using the collaborative tool MIRO according to a very refined template, and afterwards, the process of discussion and convergence of the ideas began, grouping them together, hierarchising them and extracting the 5 ideas and strategies from each team (total 60')
- Finally, in the last half hour, the 10 ideas that were considered most relevant in the workshop (with all the teams) were pooled and converged among all of them, and which subsequently formed part of the Think Tank's conclusion process.

Every parallel Think tank had 8 topical themes (5 specific and 3 digital focused) and the process of convergence of the conclusions followed a twofold process of ranking the 25 most relevant ideas of the think tank, and a second more elaborated process of ranking all ideas according to the "Best and most inspiring ideas quadrant" which included the classification ESG (Environment, Social, Governance) plus the cost-effectiveness criteria.

For the criterion of integration of all the conclusions of the different workshops and think tanks



according to the spirit of the New European Bauhaus, 2 NEB workshops were organized with an innovative methodology generating from the ideas generated in the different workshops inspiring statements and inspiring images. The final conclusions of the Think tank on sustainable buildings consisted of the integration of the main conclusions of each of the different Think tanks.

It was a very successful event in which participated 86 international students and 117 professors, researchers, and professionals, and many different SUSBCC partners joined us in this activity. In addition to ESA-ESAC, 7 other major international companies, and professional associations, research centres, a foundation, 5 European universities (Metropolia, Stuttgart, Teeside, BME and ITU) actively participated. The ratings of between 8 and 9 (out of 10) in most of the categories surveyed and the dozens of lessons learned in the critical balance process complete the successful experience of this activity.

# 5th October, 2023

14:00 -15:30

Promoting an entrepreneurial and innovation-driven culture and ecosystem

Chair of the session: Petra Moog (ZHAW)

📍 Central Library - Room 4.2

- P.36** • An innovative project "Multi-purpose nuclear town" by **Mahmut Cüneyt Kahraman (ITÜ)**
- P.38** • SUSBCC – PEHK: Proptech Entrepreneurship Hackathon by **M. Carolina Hernández Martínez (UPM)**
- P.41** • Sustainable Business models assessment on impacts and stakeholders motivation by **Jaime González-Masip (UPM)**
- P.44** • Social entrepreneurship in chemical engineering degree. An enviromental approach to the EELISA Communities by **Isabel Carrillo (UPM)**



## AN INNOVATIVE PROJECT “MULTI-PURPOSE NUCLEAR TOWN”

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**Conference Topic:** Entrepreneurship and Innovation

**Key words:** energy innovation, sustainability, clean energy, energy supply security

### ABSTRACT

Global warming is a significant environmental challenge that posing a threat to the world. Several developed countries and non-governmental organizations have recognized the issue and have taken action to combat it. However, a substantial proportion of countries have not yet contributed to the solution. Meanwhile, the energy demands of both developed and developing nations have increased with the rapid growth of industry. Therefore, nations must ensure their energy supply security to promote sustainable development. This paper introduces an innovative solution, the **Multi-Purpose Nuclear Town (MUNO)**, to address both climate change and energy supply security issues through a sustainable and innovative nuclear district project. The proposed project offers a novel solution to Europe's energy supply problem, which European universities must not only acknowledge but also participate in. The study proposes a unique nuclear project that has not been implemented anywhere globally. It argues that commissioning a multi-purpose nuclear power plant is feasible and offers several advantages. Initial technical studies demonstrate that this power plant can meet the technical requirements to generate clean energy in various ways without carbon emissions.

The present project is designed to be implemented in a developing country with an escalating energy demand, such as Turkey, focusing on an industrial district that requires high-temperature steam for industrial applications and electricity. Kocaeli, one of Turkey's industrial cities, is a potential location for the project. The project proposes the use of a 200 MW Small Modular Molten Salt Reactor (SMMSR) as the primary energy production facility for MUNO, supplying both high-temperature steam and electricity to the industrial district. Molten salt reactors generate high-temperature steam via the fission process in the reactor, which can be utilized for hydrogen





production in addition to industrial processes. During low energy demand periods, the high-temperature steam is channeled to a hydrogen production facility that uses thermo-chemical sulfur iodine (S-I) cycles to produce hydrogen. During high energy demand periods, steam is either delivered directly to industrial companies for industrial processes or to turbines to generate electricity. Additionally, waste heat generated from the last loop of the power plant after electricity generation can be employed for district heating. MUNO provides 200 MW of carbon-free electricity, ensuring energy supply security, which is particularly crucial in light of the Russian invasion. MUNO can serve as an entrepreneurial model for encouraging innovation in future energy policies. However, the project necessitates comprehensive technical investigation (neutronics and thermal-hydraulics) to design the reactor-hydrogen production facility-district heating system, and therefore, requires funding from governments or NGOs. Possible partners in the project include governments, policymakers, IAEA, nuclear regulators, universities, research centers, and private companies, among others



## SUSBCC – PEHK: PROPTECH ENTREPRENEURSHIP HACKATHON

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**Conference Topic:** Entrepreneurship and Innovation

**Key words :** Hackathon, challenge-based learning, Proptech, Digitalisation, ESG, Sustainability.

### ABSTRACT

After the successful “Think Tank on Sustainable Buildings” organized by the ESA-ESAC and the EELISA Community SUSTAINABLE BCC (SUSBCC, Sustainable Buildings, Cities, and Communities), we decided to keep on moving with the students towards the environment in which will be operating in the coming years: SUSTAINABLE, EFFICIENT & DIGITAL BUILDINGS, CITIES, AND COMMUNITIES, this time focusing on entrepreneurship and digitalisation.

Following the relationships established with our colleagues from BME and taking advantage of an international master's program on digitalisation they are teaching, we jointly designed this activity, which was later joined by SUSBCC community professors from ITÜ and PSL.

The aim was to face one of the challenges associated with improving the efficiency and sustainability of our buildings and cities, which involves raising awareness among our Eelisa students about the Industry 4.0 and the digital potential while promoting entrepreneurship for the necessary developments of new applications. This activity was a very good opportunity for the participating students to acquire a global and comprehensive vision to generate new entrepreneurial and business ideas to support the improvement of the efficiency and sustainability of our buildings, cities and communities from the double perspective demanded by today's European society:



- DIGITAL&EFFICIENT buildings and cities through PROPTECH (Industry 4.0) development taking advantage from the synergies and potential offered by digital trends.
- SUSTAINABILITY through the perspective of responsible and sustainable investments (RSI) as a criterion of a new business philosophy for the selection of investments integrating ESG (Environmental, Social and Governance) criteria.

The activity was designed to foster the awareness and commitment of tomorrow's European professionals. It took place from 5th to 8th of June in a face to face creative and collaborative international environment with the participation of students, professors, and professionals. It was held in Madrid, at the UPM's School of Architecture.

The educational project was designed as a RolePlay-Hackathon in which students, grouped in international work teams (future start-ups) participated in a condensed Proptech entrepreneurship programme. They explored and identified digital trends and technologies with innovative applications, participated in workshops to develop their business idea, received information on key enabling topics, training in transversal skills, and formulated a business proposal that competed in a Mock Investors' Forum simulating the process of seeking funding.

The investors awarded the most suggestive start-ups with the greatest potential for market impact from the PROPTECH and ESG perspectives to promote more efficient and sustainable buildings, cities and communities.

It was a four-day activity. The first day was dedicated to exploration in Proptech and ESG, with five groups of digital technologies (DT) to probe through parallel visits and activities. These were:

- DT1-Building Management & Operation: BMS, BEMS, CAFM, IWMS.
- DT2-Geo-Computing: Scanners, drones, SLAM Systems, BIM.
- DT3-Digital Twins & Virtual Reality.
- DT4-Monitoring & IOT for smart buildings and cities.
- DT5-Artificial Intelligence for buildings, cities, and communities.

After two workshops (WD1 - Brainstorming & Ranking, and WT2 - Business Idea Definition) walking through a process of brainstorming, analysis, and convergence of ideas, each of the start-up teams selected their business idea for the Hackathon. The day ended with a welcome networking.



On the second day, three instrumental workshops were developed: WT3 - Business Idea Development, WT4 - Business Plan and WT5 - Project Management Plan. On the third day, two workshops to train transversal skills were carried out: WT6 - Marketing Strategies and WT7 - Communication Strategies.

Finally, on the morning of the fourth day, the hackathon itself was held, in which the start-ups had to mature and develop their ideas and prepare to sell their proposals in a professional manner in front of an investor's forum with participating companies.

The proposals presented by the teams were very well developed and the investor forum positively valued the work done in such a short time. The start-ups shared out funding of 8,000,000 million (fake) euros, with the top three winners receiving Investor Forum awards. Teams' performance was impressive.

The awards ceremony was completed with the audience award, and seven other prizes awarded by partner companies of SUSBCC Community and by EELISA itself. The subsequent networking with the companies, rounded off an activity that achieved very high satisfaction rates among the more than 100 people involved (35 international students).

Once again, the students learned, acquired knowledge, developed skills that bring them closer to the employment market along with a level of commitment to sustainability that gives meaning and compensates both the organisational effort of the Community and the active participation of the companies. Moreover, everyone enjoyed a life experience to remember.

This activity, planned and developed with SUSBCC members from BME, ITU, PSL and UPM, with the active participation of ten partner companies and three professional associations, 7 of which granted specific awards to the start-ups, meets all the Community objectives for this activity, including building community on a national and international scale.



## SUSTAINABLE BUSINESS MODELS ASSESSMENT ON IMPACTS AND STAKEHOLDERS MOTIVATION

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**Conference Topic:** Entrepreneurship and Innovation.

**Key words:** Sustainable business models, sustainable development, stakeholders, value proposal, assessment, indicators.

### ABSTRACT

Sustainable business models, or business models for sustainability, aim to deliver, in addition to economic value, the creation of diverse types of value for multiple stakeholders simultaneously (Bocken et al., 2013, 2014; Baldassarre et al., 2017; Dembek et al., 2022). Sustainable entrepreneurship involves business innovation that contributes to sustainable development (Schaltegger and Wagner, 2011; Lans, Blok and Wesselink, 2014). The development of business models for sustainability is, therefore, one way in which entrepreneurs and business people can meet the requirements of sustainable development (Evans et al., 2017).

From a systemic sustainability perspective, the level of sustainability of a business model depends on the intensity and impacts it generates, through its business activity, on its economic, natural and social environment, and how responsibilities for these can be allocated (Goffetti et al., 2022). Production and consumption business models have essential environmental and social impacts that can be identified and classified (Lüdeke-Freund et al., 2018). This makes it possible to identify more or less sustainable production and consumption patterns associated with specific industries or sectors of economic activity, such as food, housing, household appliances or transportation that show a higher environmental impact (Bocken, Niessen and Tukker, 2022). A business model generates impacts of different nature and intensity depending on its idiosyncrasies, so it would be useful to categorize them.

On the other hand, the value creation perspective is important in the analysis of sustainable business models (Sommer, 2012). In a business model, relationships between stakeholders can be identified, in which stakeholders interact in the value creation process and are both recipients and creators of different types of value (Freudenreich, Lüdeke-Freund and Schaltegger, 2020).



Therefore, it is interesting to know what kind of value the company creates, the relationships between stakeholder groups, who receives value and who creates value. Although different stakeholder groups have genuine and legitimate interests that differ from each other, it is normal that similar interest groups, e.g. investors and business owners, will show similar preferences in different scenarios due to their role and nature (see, Penzenstadler, Femmer & Richardson, 2013). Thus, it is possible to identify and weight the type of value they expect and offer or, for example, to rank them by the importance given to one of the three dimensions of sustainability (Kumar, Rahman, & Kazmi, 2016).

This research seeks to define an integrative framework to assess and categorize the degree of sustainability of business models according to two criteria, which are, firstly, the motivation or value perceived by the different stakeholders and, secondly, the level of impact of the business activity according to the characteristics of the business model analyzed. The working method, in this first phase of the study, is the literature review of the existing literature on assessment and evaluation of sustainable business models (or business models for sustainability), as well as on other theoretical approaches that, in an integrative way, justify the model to be proposed.

As a result, a theoretical proposal for the stakeholder value creation framework (valuation matrix) and the identification of the impact of the business model (impact matrix) will be obtained. Both matrices are combined to obtain the overall sustainability assessment of each business model.

The proposal aims to maintain a high level of flexibility and applicability.

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## SOCIAL ENTREPRENEURSHIP IN THE CHEMICAL ENGINEERING DEGREE. AN ENVIRONMENTAL APPROACH TO THE EELISA COMMUNITIES

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**Conference Topic:** Innovative pedagogies & Engineering education

**Key words:** Learning by doing, active methodology, engineering, environmental, sustainability

### ABSTRACT

One of the main objectives of an engineer is to improve people's lives and build a society more inclusive and fairer. The Escuela Técnica Superior de Ingeniería y Diseño Industrial (ETSIDI) of the Universidad Politécnica de Madrid (UPM) is developing educational innovation pedagogies with a focus on Sustainable Development Goals, SDGs and understanding the international dimension of engineering and architecture through EELISA communities [1, 2]. Among SDGs, SDG 11, that is, making cities and human settlements inclusive, safe, resilient, and sustainable was chosen. To achieve this, the STEAM methodology will be used, which integrates science, technology, engineering, arts, and mathematics, as well as mediation, mapping, diagnosis, and citizen participation to establish Service-Learning actions [1]. This allows to student develop creative and technological skills and learn about sustainability issues in a playful and participatory way. The objective of this type of methodology is to create new learning spaces to promote experiential learning as a complement to the formal curriculum, acquisition of Soft Skills, and contribute to the development of university students with a social sense increasing their curiosity and self-motivation [3].

Students and university staff and researchers of two different *communities Industrial Design for Human and Tech Diplomacy & International Cooperation* of the ETSIDI have participated in research and innovation projects and social entrepreneurship, events and activities that promote the exchange of ideas and the training of multidisciplinary professionals. These actions allow students to acquire a more global vision of the discipline, strengthening their training and preparing them to face current and future challenges.



In this sense, students of the Chemical Engineering Degree have participated in a new project centered in downtown Madrid, concretely in Lavapiés/Embajadores neighborhood. In the first step, students analyzed the necessities of the neighborhood using mapping and analysis tools, such as surveys, interviews, maps, and photographs. Afterward, they identified the main problems and needs of the environment and design appropriate intervention strategies. Among these problems, the quality of the fountain's water was detected, and neighbors are worried about it.

They think that the taste and the quality of the water are not adequate.

To develop the project, students were divided into different groups. Different fountains (potable and non-potable) were selected to analyze the quality of the water. The collection points were identified on a map, identifying the characteristics of the place where the sample of water was collected. In a second step, groups of students with the help of PDI and PAS collected the samples in special containers to avoid any contamination of the water. ~~Samples were identified and stored adequately to analyze.~~ Different chemical parameters such as conductivity, turbidity, pH, and the presence of coliforms were analyzed in the laboratory. Afterwards, the results of the analysis were discussed taking notice of the influence of the zone where they were obtained.

Students have created a map with the results obtained from the measurement. They have classified it and have made a material that will be shared with the neighborhood community.

In this sense, the developed activities have been attractive and understandable for all the participants and members of the community, and it is intended to make a transfer that combines Art + Science. These types of activities allow to the students learn within the subject with tasks and practical work providing a service to the territory and solving the challenge that arises from SDG 11 which it is considered how we live and how we can improve the habitability of the squares in the neighborhoods that are the object of the service. Moreover, the students have improved their oral communication skills, and the capacity to communicate information in different not specialist environments [4]. At the same time, they have tried to make the inhabitants of those zones aware of the importance of reducing pollution in our cities. To improve social entrepreneurship in the Chemical Engineering degree with an environmental approach to the EELISA communities thanks to this program we need to:

- Incorporate Environmental and Social Responsibility initiatives like ES NUESTRO.
- Encourage Interdisciplinary Collaboration: Foster collaboration between Chemical Engineering students and students from other disciplines, such as environmental science, business, and social sciences.
- Offer Entrepreneurship and Innovation Programs: Provide entrepreneurship training programs or workshops tailored to Chemical Engineering students.
- Promote Field Studies and Community Engagement: Encourage students to engage with EELISA communities and other local communities facing environmental challenges like ES NUESTRO.



These experiences and methodologies allow us not only to improve the learning and motivation of our students but also to achieve a more active and aware citizenship of their environment and to promote the sustainable development of communities. By implementing these kinds of strategies, the Chemical Engineering degree program can foster a culture of social entrepreneurship with an environmental approach [4], preparing students to be catalysts for positive change in the EELISA communities and beyond.

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# 5th October, 2023

16:00 -17:30

## Building Sustainable Cooperation in EELISA

**Chair of the session:** Claudia Lehmann, HHL Leipzig Graduate School of Management

📍 Central Library - Room 3.1

- P.48** • BEE'NOME: A Stakeholder Engagement Tool for Improving the Quality of Learning and Teaching in the Higher Education Ecosystem by **Hakan Yorulmuş (ITÜ)**
- P.51** • Facilities 4 EELISA Collaborations by **Antoine Mercier (PSL)**
- P.53** • Partnerships orchestrating sustainability transformations (POST): results and opportunities for future collaborations by **Supriya Singh (FAU)**
- P.57** • The ideation process of the hackathon as an educational practices of integrating university, companies and community learning by **Óscar O. Santos-Sopena (UPM)**



## **BEE'NOME: A Stakeholder Engagement Tool for Improving the Quality of Learning and Teaching in the Higher Education Ecosystem**

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**Conference Topic:** Building sustainable cooperation

**Keywords:** Human Resources Analytics, Stakeholder Engagement, IT Platform, Higher Education Institutions, Co-learning, Active Learning.



## **ABSTRACT**

Research findings in various educational settings show that external stakeholder engagement has been pivotal in improving the quality of teaching and learning in higher education institutions (HEIs). The field of teaching, known as pedagogy, has exhibited remarkable stability over time, which presents a significant challenge in achieving high-quality learning experiences within educational institutions. Additionally, the absence of appropriate digital tools further hampers the development of active learning (AL) environments in collaboration with external stakeholders.

However, by reorganizing the learning landscape and embracing easily accessible, modular, flexible, and scalable approaches and tools with an AL mindset, there exists great potential to overcome the limitations of traditional instructional design formats. This reconfiguration can also facilitate the recognition of various forms of learning through collaboration with industry partners, thus enhancing the overall learning process within higher education institutions.

This paper aims to elucidate on the development process of a digital platform at Istanbul Technical University (ITU), called BEE'nome, -a new generation co-creation platform- to support stakeholder engagement, and build sustainable collaboration with the internal and external stakeholders of the HEIs to create communities of co-learning. The platform targets not only intra-institutional stakeholders such as students, academics, and administrative staff, but also third parties including but not limited to industrial actors, NGOs, and society at large.

Recognizing the importance of enhancing the learning environment in higher education institutions (HEIs), there is a necessity to create innovative AL environments utilizing digital tools. To address this need, a digital platform has been developed to facilitate sustainable collaboration between academic and industrial stakeholders. This platform aims to improve the overall quality of learning by aligning students' and graduates' skill sets with industry requirements. Moreover, it aims to enhance the teaching capabilities of academics by focusing on pedagogy, curriculum development, and assessment techniques. By adopting a comprehensive approach to learning, these initiatives aim to holistically improve the quality of education in HEIs and the exchange of innovative pedagogies among the EELISA partners and the associated externals.

BEE'nome, equipped with various matchmaking functionalities for different purposes, maps the human resources within the ITU ecosystem with keywords, which correspond to their areas of skills and expertise that they volunteer to exchange with the other members of the ecosystem. The ecosystem currently is composed of around 200,000 ITU members including stakeholders such as; students, academics, administrative staff, and alumni. The platform allows users to take different roles such as learner, mentor, project manager, and researcher, amongst others, while they exchange their know-how. BEE'nome currently allows ITU Center for Excellence in Education (ITU CEE) to directly engage with the selected segments of the ITU ecosystem indicating that a learning experience (value offer) is available for them based on their keywords, which can be updated anytime by the users.

ITU CEE uses BEE'nome to access various stakeholders not only for learning experiences that are targeted at the masses (e.g., inviting groups for a webinar or a YouTube Broadcast) but also



designing highly value-added learning experiences targeting specific learners (e.g., a learning experience for Ph.D. students in a specific field). ITU CEE aims to add functionalities to the BEENOME prototype to match users with other learning opportunities such as internships, research projects, and mentorship, to name a few, in addition to courses or other channels in formal settings. BEE'nome has a modular software architecture that will allow the exchange of Lego-like learning experience designs that will be accumulated and circulated with its members from a co-creation mindset. The emphasis of these initiatives is to encourage the adoption of innovative teaching methods and elevate the quality of education by implementing modularization and collaborative learning strategies.

The current phase which was funded by The British Council, The International Association of Maritime Education, and ITU, BEE'nome will function as a Knowledge Hub that promotes innovative pedagogies and disseminates good practices in the teaching and learning field. BEE'nome not only serves as a strong stakeholder engagement tool to improve the quality of learning and teaching in the ITU but also contributes to the broader higher education system. Moreover, these initiatives aim to promote creativity and advancement in the methods of education and knowledge acquisition within the framework of EELISA.





## FACILITIES 4 EELISA COLLABORATIONS

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**Conference Topic:** Building sustainable cooperation

**Key words:** Facilities, Collaboration, Share, Visibility, Resilience

### ABSTRACT

One of the objectives of EELISA innoCORE is to promote a fluid use and access of the existing research facilities for the EELISA community. To this end, a first task was focused on the identification and listing of the existing resources within EELISA. The facilities we have targeted are not only those already part of international network, but also technological platforms or resources developed by EELISA partners willing to open them either in a collaborative or partnership fashion. This mapping has also enabled us to identify a network of facilities available for teaching purposes (ex. allowing the setup of teaching modules across the different platforms of the partners) both for a researcher and student public. The catalogue is composed by 260 entries as of June 2023.

We are convinced that gathering this knowledge could:

- increase the visibility of the infrastructures via the EELISA website available to all,
- help in connecting researchers and in spreading the use of the specific procedures and methods developed by the EELISA partners,
- contribute to more resilient research communities,
- allow the creation of a unique environment for teaching allowing students to access not only well-established instrumental setups but also state of the art research infrastructures and techniques in a large variety of fields.

Nevertheless, a mapping exercise becomes very quickly obsolete and cannot support our objectives. That is why we have designed a digital catalogue that will be available on the EELISA website at the time of the conference so that this information becomes available with an easy process to update it from a bottom-up approach. We rely on the experience of UPM that created



its catalogue few years ago which is totally operational. It is expected that the EELISA catalogue of facilities will follow the same path.

Having an IT tool is not enough. We also need clarify sharing/access rules. Indeed, access to information and contact making would be useless if there is no clear administration environment for the collaboration. Given the wide diversity of situations, we realized that adopting a uniform set of rules would not be possible. Thus, we suggest that the basic rule for EELISA would be that any EELISA user would be considered as *internal user* and obey to the local rules applicable to internal users including the decision process to agree on the access of such facility. To fully apply and implement it, this will request internal validation in each member.

With these two characteristics – being digital/live and including sharing rules – the EELISA catalogue is expected to raise interest from academics and then supports (new) collaborations within the Alliance on a bottom-up approach.



## **PARTNERSHIPS ORCHESTRATING SUSTAINABILITY TRANSFORMATIONS (POST): RESULTS AND OPPORTUNITIES FOR FUTURE COLLABORATIONS**

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**Conference Topic:** Building sustainable cooperation

**Key words:** Cross-sector partnerships, collaboration, business and human rights, corporate sustainability strategy, sustainability transformation

**Type of Abstract:** Extended abstracts presenting an EELISA relevant case study

### **EXTENDED ABSTRACT**

#### **Introduction**

Sustainability challenges fall into social, environmental and economic domains and are complex, wicked and transboundary in nature. Responding to these challenges effectively requires the involvement and cooperation of different stakeholders - private companies, international organisations, civil society groups, academia, government bodies and local communities. Moreover, current challenges require levels of collaboration of unprecedented width and depth among incumbent actors (Waddock et al., 2015; Dentoni et al., 2018). However, how to create and manage multi-stakeholder partnerships that have the potential to be truly transformative by contributing to solving complex sustainability challenges is still an open question (Moreno-Serna et al, 2020, Soberón et al, 2022).



Partnerships Orchestrating Sustainability Transformations (POST) is an EELISA initiative dedicated to understanding cross-sector partnerships for sustainability transformations through exploring its meaning, dimensions, context and nature in Europe, Asia, Latin America and Africa through interdisciplinary research, exchange and collaboration. It was initiated in response to the first funding call for joint institutional activities in September 2022 by three EELISA institutions: Friedrich-Alexander University Erlangen-Nürnberg (FAU, Germany) in Germany, Scuola Normale Superiore (SNS, Italy) and Universidad Politécnica de Madrid (UPM, Spain). From January to May 2023, three workshops were organized by SNS, UPM and FAU. This contribution describes the main objectives and results of the initiative, as well as some opportunities for further development.

### **Main objectives of POST**

The initiative was proposed with the following fundamental objectives:

- 1. Build understanding - To build an understanding of the nature and role of cross-sector partnerships from a Corporate Sustainability as well as Business and Human Rights perspective in dealing with the complexities and challenges of sustainability transformations.
- 2. Create a community of practice among EELISA members and beyond – Share best and failed practices for cross-sector partnerships, including challenges, opportunities and learnings.
- 3. Develop skills – Develop skills necessary to research on, build, manage, sustain and learn from effective cross-sector partnerships.
- 4. Facilitate networking - Creating opportunities for future collaboration amongst the participating institutions and its participants specifically on research on partnerships and collaboration.
- 5. Promote innovation - Encourage participants to think creatively and develop new approaches to cross-sector partnerships for sustainability transformation.
- 6. Foster inter-cultural exchange - Organize social and cultural activities to promote networking and inter-cultural exchange.

### **Brief description of the workshops**

The first POST workshop in Florence was held in January 2023 and was devoted to establish a common ground of theoretical perspectives and have an initial exchange among group members to share different understandings on partnerships in different contexts, key foundational elements, key success factors and main challenges involved.

Through the second workshop in Madrid (March 2023), the POST community consolidated and enlarged their conceptual base by adopting a practical and context-sensitive approach.



After a reflection on the different meanings and configurations of partnerships and the importance of the context, the workshop was devoted to unfolding the concept of “Partnership’s lifecycle”, a well-known framework in the frontier between practice and academia. A number of real case-studies in different contexts (urban transformation, ICT for development, fulfilment of human rights) were also presented.

Finally, a Spring School was organized in Nuremberg in May 2023. The School focused on deepening the understanding of multi-stakeholder partnerships from a double perspective: the Corporate Sustainability and the Business and Human Rights perspectives. The event included three master classes dealing with the ethical implications of partnerships; the external, organizational and individual drivers for partnerships; and the transformative impact of partnerships in learning and innovation. Additionally, a discussion was organized around a spectrum of multi-stakeholder partnership examples around the world as well as a session on different theoretical frameworks applied to multistakeholder collaboration.

### **Main outcomes and future developments**

Along the three workshops, the initiative has succeeded in establishing an initial network of students, researchers, practitioners and faculty involved in cross-sector partnerships for sustainability within EELISA. So far, over 10 master students, 20 PhD students, 8 faculty members and 6 practitioners representing more than 15 nationalities have been directly involved in the initiative. Additionally, over 60 people joined the various on-line events associated to the three workshops.

Through the exchanges, a common empirical and theoretical ground has been established, as well as an initial exploration of personal and organizational incentives of the partners, which is an essential condition to develop more specific collaborations in the future. Some possible further developments are:

- Exploring with more detail the differences and similarities between the corporate sustainability perspective and the business and human rights perspective, particularly in terms of possible cross-learning opportunities.
- Continue exploring ethical implications of cross-sector partnerships for creating a productive interdisciplinary dialogue between different experiences and theoretical traditions related to partnerships and collaboration.
- Contributing to developing a capacity development strategy within EELISA, addressed to the members of the academic community involved in cross-sector collaboration. More widely, contributing to the reflection on how to create favorable collaboration conditions within EELISA.
- Exploring with more detail the differences and similarities between the corporate sustainability perspective and the business and human rights perspective, particularly in terms of possible cross-learning opportunities.



- Continue exploring ethical implications of cross-sector partnerships for creating a productive interdisciplinary dialogue between different experiences and theoretical traditions related to partnerships and collaboration.
- Contributing to developing a capacity development strategy within EELISA, addressed to the members of the academic community involved in cross-sector collaboration. More widely, contributing to the reflection on how to create favorable collaboration conditions within EELISA.

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# THE IDEATION PROCESS OF THE HACKATHON AS AN EDUCATIONAL PRACTICE OF INTEGRATING UNIVERSITY, COMPANIES, AND COMMUNITY LEARNING

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**Conference Topic:** Engineering education

**Key words:** Hackathon, Quality Education, Design, Sustainable cities

## ABSTRACT

In educational environments, new techniques and initiatives are increasingly used to dynamize learning for approaching challenges in society. Consequently, Hackathon development is rapidly spreading out among universities due to the multiple opportunities, possibilities, and variety of participants involved. Companies are increasingly engaged with the educational community and therefore looking for ways to promote collaborations with it. Students now require more cross-cutting skills, teachers who energize the classroom and provide students with additional values and tools, and socially engaged students [1]. This is the framework for the EELISA (European Engineering Learning Innovation and Science Alliance) partnership, in which 10 Higher Education institutions located in 8 European countries aim to define and implement a common model of the European engineer [2].

In this sense, it is proposed Hackathon that connects communities, companies, and universities for exchanging knowledge, needs, and opportunities. First, the Community brings its users, fundamental day-to-day objectives, work field, and overall context. Second, the Company shares its resources, expertise, and professional approach. And third, the University contributes with its methodologies and tools for creating meaningful and valuable solutions. In this way, the three different perspectives can be optimally integrated for building a comprehensive approach to the challenge and enhancing the design process. To achieve viable and enriching solutions in the Hackathon, the ideation phase is crucial. This initial stage, without which the challenge cannot progress, is often considered by students to be the most difficult and tedious due to the





prominent level of creativity it requires. To support and facilitate this creative process, different methodologies can be employed. One of the most popular methodologies for ideation is Design Thinking, which offers a wide range of tools and possibilities [3]. For this reason, the use of the Design Thinking methodology provides highly effective tools to undertake this creative phase, such as research guidelines, people sample profiles, or the Safari tool, among others. Implementing Design Thinking in such a practical and exciting event as Hackathon will boost the idea generation, motivation, and creativity of all participants for achieving optimal outcomes.

During the Hackathon event, participants were able to generate a variety of innovative ideas to tackle the challenge presented. The Design Thinking methodology, alongside the use of research panels and persona profiles, helped accelerate the ideation process. Despite the time constraint of only three hours, the students generated many ideas that were later analyzed for technical, social, and economic feasibility. The mentoring provided during the event was also crucial in guiding the teams and providing expertise to support the development of the ideas [3,4].

One of the main results of the Hackathon was the identification of several viable solutions to the challenge presented. The creativity and innovation exhibited by the student teams resulted in a diverse range of ideas, many of which had prospects for real-world implementation in the near territory and communities. This is one of the main goals of our EELISA community (*Industrial Design for Human - ID4H*) and university mission and vision. Additionally, the event provided a chance for the students to develop their problem-solving skills and work together with others.

The experience obtained during the Hackathon could be applied to future academic and professional endeavors.

Based on the results from the Hackathon, this type of initiative is a valuable tool for promoting innovation and creativity among university students. The event provided an opportunity for students to work collaboratively in a supportive environment, with guidance from mentors and access to a range of resources and tools. This collaborative approach helped to generate a wide range of creative ideas and solutions to the challenge presented, and many of the ideas generated showed promise for further development and implementation. The didactic implications of this type of initiative are significant. The Hackathon model can be adapted and applied in a variety of educational settings, providing students with an opportunity to develop their creativity and innovation skills, while also promoting a collaborative approach to problem-solving [3]. By engaging with real-world challenges and working alongside professionals in the field, students can develop a deeper understanding of the challenges and opportunities associated with their chosen discipline and gain valuable experience in working as part of a team to generate and develop innovative solutions [3].

Overall, the success of the Hackathon suggests that initiatives of this type have significant potential as a means of fostering innovation and creativity among university students. By providing a supportive environment, access to resources and tools, and guidance from experienced mentors, these initiatives can help to develop the skills and competencies that are



essential for success in a rapidly changing and increasingly complex world [4]. As such, there is a clear need for continued investment in such initiatives, and for the development of new and innovative approaches to promoting creativity, mediation, and educational innovation.

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# 5th October, 2023


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16:00 -17:30

Engineering Education: sharing practices

Chair of the session: Pascal Bigey (PSL)

📍 Aula Conference Centre - Room 2.1

- P.61** • Developing an interactive simulation environment for teaching applied of manufacturing engineering subjects **Piera Maresca (UPM)**
  - P.64** • Report on the 1st EELISA Scientific student Competition by **Balázs Kövesdi (BME)**
  - P.65** • Research-based learning for obtaining a new sustainable material from local organic waste within a circular economy framework by **Cristina Moreno-Díaz (UPM)**
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## DEVELOPING AN INTERACTIVE SIMULATION ENVIRONMENTS FOR TEACHING APPLIED OF MANUFACTURING ENGINEERING SUBJECTS

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**Conference Topic:** Engineering education

**Key words :** Engineering Manufacturing subjects; DE-learning; Active learning; Just In Time Teaching

### ABSTRACT

In this communication we describe the objectives, methodology and structure of a virtual didactic environment developed by the educational research group New Teaching Methodologies in Mechanical Engineering and Manufacturing at the Universidad Politécnica de Madrid (UPM), and members of the EELISA Industrial Design for Human (ID4H) Community, designed to carry out practical lessons of several manufacturing process subjects. This development has allowed teaching to be focused on the student in a *DE-learning* (driven electronic learning) environment capable of efficiently replacing the traditional method based on master classes and practical hands-on experience with real equipment. In fact, the virtual environments direct and assist students, step by step, in their practical experience, proving dynamic and interactive by animations, video and audio contributions, connections with hypertexts and simulations [1-3]. The model presented in this communication seeks a progressive adaptation to the new training paradigms, incorporating emerging communication technologies so that students can harness an even greater role that has hitherto been untapped, hence approaching one of the objectives of the EELISA Alliance to contribute to engineering education with innovative methods and “*to define and implement a common model of European engineer rooted in society*”.



Currently, teaching of manufacturing processes is present in different subjects of the Bachelor's Degrees taught at the Escuela Técnica Superior de Ingeniería y Diseño Industrial (ETSIDI) of UPM [4], such as:

- **Manufacturing Technologies:** subject of second-year, mandatory in all Degrees taught at the ETSIDI. Here, the students receive their first contact with the most common manufacturing processes. We must consider the current industrial environment without forgetting, the origins and evolution of all the studied processes. The subject "Manufacturing technologies" is of an eminently applied nature and has a marked integrating and complementary character with previous subjects and a propaedeutic character with other subjects present in the curricula.
- **Welding** is also a second-year subject taught in parallel to Manufacturing Technologies. In fact, in other curricula Welding is included in a limited way, with no lab sessions. Welding brings both, practical and theoretical approaches, which aims to describe the different welding processes and the study of the metallurgical influence that it entails, which determines the final mechanical properties of the joint. In addition, non-destructive inspection methods are studied to determine the quality of the welded joints.
- **Computer Aided Manufacturing:** subject of third-year, mandatory for Mechanical Engineering students. This subject is of an eminently applied nature, it also has a strong correlation with the previous and following subjects and has a complementary character with other subjects present in Mechanical Engineering's curricula. Here, the students complete their "Machining" training process, especially in the field of computer-aided manufacturing.
- **Flexible Manufacturing Systems:** compulsory subject of fourth-year. The theoretical and applied contents of this subject are based fundamentally on the description of the robotic systems of manufacturing, programming, and sequencing of production, planning methods and control of operations and products manufactured.

All these subjects are aligned with the SDG's 3: Ensure healthy lives and promote well-being for all, 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities, 5: Achieve gender equality and empower all women and girls, 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation and 12: Ensure sustainable consumption and production patterns. The use of different equipment and manufacturing software are fundamental in the field of engineering manufacturing processes to obtain the necessary knowledge for the manufacture of complex products. Since the number of enrolled students is way larger than the availability of equipment, it was necessary to create and develop virtual teaching platforms as virtual manufacturing laboratories to simulate the operation of the different equipment and to develop the work of practices by students and their subsequent



evaluation, being a useful and easy tool to complement the teaching of the practical classes.

The platforms have been developed with the software house Macromedia, allowing the creation of a multimedia application with high-quality animations. Scripting languages have likewise been incorporated, permitting the evolution of even more complex elements for user interaction. The environments have been undertaken in Spanish and English with a view to meeting the communication needs of students in a multicultural environment, in harmony with the framework program for didactic strategies in the European Higher Education Area.

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## Report on the 1st EELISA Scientific Student Competition

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**Conference Topic:** Research-based learning

**Keywords:** Scientific student competition, research-based learning methods

### ABSTRACT

A joint interuniversity task force led by BME organized the 1st EELISA International Student Scientific Competition, inspired by the Hungarian domestic OTDK with more than seventy years of tradition, with the moral support of the Hungarian Scientific Students' Association (OTDT). The event was part of the 2nd Research-Based Learning Symposium of the EELISA project on 17-18 May 2023 in Pisa, Italy. Its nine thematic sections attracted 101 students from seven EELISA partner institutions (with 70 students' presentations). This year's tradition-creating event ended with great success, as indicated both by the feedback from students and instructors.

The main goal of such extracurricular activities is to educate the best students motivated to work in R&D after graduation on the basics of research methods and related soft skills, like research strategy planning, (partially interdisciplinary) teamwork, documentation, and presentation of results. The competitive conference offered a unique opportunity for the best students at the partner universities to present their extracurricular research. A typical student's work starts from selecting the topic initiated by an academic researcher, industry, or the student himself (or their team) and the commitment of a staff member to act as a tutor. The active phase typically takes at least one semester, but multiple research iterations may continue for years and conclude in the presentation.

The presentation will summarize the rules and the organizational aspects of the 1st scientific student competition, giving a global overview of its perspective for the future. The presentation will also introduce the rules and evaluation process of the competition and their advantages for the students and their supervisors.





# RESEARCH-BASED LEARNING FOR OBTAINING A NEW SUSTAINABLE MATERIAL FROM LOCAL ORGANIC WASTE WITHIN A CIRCULAR ECONOMY FRAMEWORK

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**Conference Topic:** Engineering education

**Key words:** Research-Based Learning, Quality Education, Responsible Consumption, Circular Economy.

## ABSTRACT

Within the EELISA Industrial Design 4 Humans community, there is a great concern about the increase in food waste. In addition to being a moral issue, this waste poses a significant threat to the environment, as it is directly responsible for 8% of global greenhouse gas emissions. According to a study by the Food and Agriculture Organization of the United Nations (FAO), approximately 1 kilogram of wasted food is equivalent to 2.5 kg of CO<sub>2</sub> [1]. On the other hand, the current linear model has decentralized industrial production and separated it from consumption activities, turning cities into large waste factories unable to manage it properly. Therefore, project 4 within this community focuses on "Education and Design in Consumption and Responsible Use," aiming to promote reflection in society to raise awareness of plastic material abuse and the short lifespan of many products that, nevertheless, persist as waste on the planet for a long time. This project falls within the framework of Sustainable Development Goals (SDGs): Quality Education (SDG 4) and Responsible Consumption (SDG 12).

By applying the Research-Based Learning methodology [2], various Final Degree Projects have been carried out. This methodology offers students the opportunity to engage in research processes, applying a method to verify the truth of a hypothesis and find solutions to the problem at hand while being accompanied and supervised throughout the process. This prepares them to be independent and self-sufficient in their further development [3].



Specifically, the developed projects have practically applied the design of new sustainable material by harnessing locally generated organic waste to manufacture useful products within the same environment, which can be reintroduced into the production cycle after use. This approach integrates a circular economy based on utilizing local food waste.

The material known as bacterial cellulose (BC) has been utilized, as its interest has been growing in recent years. It possesses exciting properties such as biocompatibility, hydrophilicity, mechanical characteristics, and an "eco-friendly" label, making it a potential competitor to certain known plastic materials. Therefore, it holds great potential for application in various sectors, including medicine, the food industry, packaging, textiles, and technology. Additionally, the material has attracted attention due to its potential use in creating single-use products in the current context caused by COVID-19.

The projects have taken advantage of the excellent location of the University (ETSIDI-UPM) [4] in a traditionally collaborative and open neighborhood like Lavapiés. A field study was conducted through surveys and on-site visits, which served to: Firstly, map the surplus organic materials that can be used to produce the material, identifying these surpluses in fruit shops, restaurants, and cafeterias. Secondly, identify the disposable product needs of these businesses. Lastly, establish collaboration with these raw material suppliers, which has facilitated obtaining the organic waste for BC production.

As a result, samples of the material have been produced, varying in characteristics such as flexibility, rigidity, texture, thickness, and color. These attributes are influenced by controllable parameters, including the raw material used, cultivation conditions, and the washing and drying process after extracting the film. Thus, different materials have been synthesized, exhibiting behaviors and appearances reminiscent of paper, cardboard, plastic, or even animal leather. This allows for envisioning adaptation and application in various fields, including single-use packaging, writing paper, textiles, clothing, and even furniture design.

Finally, it is worth noting that this initiative has generated great interest and appeal among external stakeholders, such as neighborhood associations and traders from Lavapiés, as well as Medialab Matadero [5]. That is a program under the Madrid City Council, created in 2002, aimed at promoting research, creation, and experimental production driven by the dynamics of the commons.

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# 5th October, 2023

16:00 -17:30

The European Universities Initiative as a pioneer of the university of the future

**Chair of the session:** Julia Funaki, American Association of Collegiate Registrars and Admission Officers (AACRAO)

📍 Aula Conference Centre - Room 2.2

- P.68** • Assessment of tangible and intangible activity impacts across and beyond the EELISA ecosystem: implications of the "Circular in Play" project by **Imge Akcakaya Waite (ITÜ)**
- P.71** • Higher Education 4.0 and its reflections on European Universities: the case of EELISA **Nilüfer Ülker (ITÜ)**
- P.72** • Implementing EELISA - Sustainable BCC Community Activities Approach by **M. Carolina Hernández Martínez (UPM)**
- P.75** • SSERIES community: Interdisciplinary Science in EELISA by **Óscar O. Santos-Sopena (UPM)**



## ASSESSMENT OF TANGIBLE AND INTANGIBLE ACTIVITY IMPACTS ACROSS AND BEYOND THE EELISA ECOSYSTEM: IMPLICATIONS OF THE “CIRCULAR IN PLAY” PROJECT

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**Conference topic:** The University of the future (primary), Impact for society (secondary)

**Key words:** EELISA activities, impact assessment, CIRCULAR IN PLAY Project, Circular EELISA Community



## ABSTRACT

The Circular EELISA Community aims to promote the development of a mindset that favors a transition to the circular economy by addressing the socio-civic competencies of future professionals. Researchers, students, external partners, and other stakeholders involved in the community share a common vision of higher education's social responsibilities and the strategic role it plays in addressing sustainability challenges. EELISA presents a timely opportunity for such groups to join forces in developing resources for an integral approach towards the circular economy by addressing the socio-civic competence gaps present in the current context. One of the projects of the Circular EELISA Community that were supported by the first EELISA Call for Joint inter-institutional Activities in Communities was CIRCULAR IN PLAY, held between September 2022 and March 2023 in collaboration between İstanbul Teknik Üniversitesi (İTÜ), Universidad Politécnica de Madrid (UPM), Universitatea Politehnica din București (UPB), and Scuola Superiore Sant'Anna-Pisa (SSSA). The project worked towards the community's abovementioned goal by enhancing awareness and knowledge of the circular economy and the accompanying socio-civic competencies across and beyond Europe, increasing knowledge and engagement about the EELISA Alliance and disseminating the participating students' productions, all of which were among the expected impacts of the project setup. This study analyzes CIRCULAR IN PLAY in terms of its international and interdisciplinary collaboration scheme, project process design, recognitions, and impacts. It also investigates the extent to which the project achieved its expected impacts and makes recommendations based on the results of the activities to enhance the success of EELISA and its communities.

CIRCULAR IN PLAY was a series of three online game nights and subsequent design activities associated with upcoming international events commemorating innovation and environment. The first workshop, 3VIA 2022, which was held on September 30th as part of the European Researchers' Night 2022 of the Marie Skłodowska-Curie Actions, involved a trivia quiz event on the three main themes of the circular economy: reduce, reuse, and recycle. The second workshop, Scape Room, was held as part of the Madrid Science and Innovation Week 2022 on November 18th and designed as a scientific parkour centered around the circular economy and its associated socio-civic skills. The third workshop, R-Express, was held on March 13th in the same week as Global Recycling Day 2023 and also as part of the ATHENS Network course UPM127 on the basics of the circular economy in the construction sector. In all the events' two-hour activities, a game-based learning setting enabled participants from different backgrounds and locations in Europe to actively partake in fun, dynamic challenges designed to pique their curiosity and interest in the proposed topics. Each of the three game-based workshops was followed by a one-week collaborative infographics design workshop, in which students from all participating countries worked further to research and produce infographics on select topics in the circular economy. In all six workshops, the primary target group was first- and second-year university students from the four organizing universities and other EELISA Alliance member institutions, while the audience comprised all levels of undergraduate and graduate students, and even some professors, from the member universities as well as across and beyond Europe.



In line with the aim and structure of the project, CIRCULAR IN PLAY attempted to achieve a number of impacts through collective learning and outreach, as stated in the project proposal of August 2022: (1) increasing awareness and knowledge of the circular economy & socio-civic competencies; (2) enhancing knowledge about EELISA; (3) awarding EELISA credentials as tokens of students' knowledge and commitment; (4) awarding Circular EELISA badges as tokens of students' commitment and action; (5) dissemination of the theme-based student deliverables; and (6) utilizing external partners' contributions. Since the successful implementation of the project, it has become clear that while many of its tangible goals were reached, some of the more intangible aims were partially met or have not yet been realized, both within and beyond the funding period. These goals included the creation of public awareness of sustainability, the promotion of EELISA among students and external partners, increasing student and researcher mobility (physical, virtual and/or blended), and the expansion of similar game-based activities across EELISA. This study elaborates on this critical approach and discusses the causal relationships between different states of impact satisfaction, keeping in mind constraints on the ability to measure impact and the relatively short time since the project's completion. Also discussed are some rather embedded impacts that were not mentioned in the proposal, such as increased engagement among the community member universities and researchers and increased capacities of both researchers and students organizing and attending the activities. The study discusses the findings of such assessments in terms of outreach strategies, stakeholder engagement, data collection and management, capacity building, and participant and organizer recognitions. The findings are accompanied by a set of action-oriented recommendations to further elevate the highly promising and inspiring framework of the EELISA European University Alliance.



## HIGHER EDUCATION 4.0 AND ITS REFLECTIONS ON EUROPEAN UNIVERSITIES: THE CASE OF EELISA

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**Conference Topic:** The University of the Future

**Key words:** Higher education 4.0, University 4.0, European Universities, EELISA, Student competencies

### ABSTRACT

The world has become a place where information can be accessed quickly and disseminated widely in the knowledge society in parallel with the speed of technological advancements. The shift of focus towards knowledge economy has necessitated the transformation of higher education institutions to meet the demands of the current era, as indicated by the commencement of the fourth industrial revolution, also referred to as Industry 4.0. Universities are now expected to have equipped their graduates with necessary competencies for the jobs of the future so that they will fulfil the professional demands and requirements of industry 4.0. To be able to achieve this, modifications have taken place in many spheres of higher education including but not limited to the adoption of new instructional methodologies, changes in the teaching and learning environment and the redefinition of student competencies in line with the requirements of the current era. In parallel with this approach, the aim of European Universities Initiative is to transform the quality and competitiveness of European higher education where the alliances are expected to become universities of the future with a specific focus on student-centred curricula and innovative teaching approaches. To this end, employing a comparative survey design, this study will explore perceptions from academics in “European Universities - EELISA” concerning the extent to which already existing academic practices match the indicators defined for academic priorities and practices of Higher Education 4.0.

Data will be collected from EELISA European University Members through a questionnaire devised by the researcher. During the development phase of the questionnaire, an item pool was created through a comprehensive literature review, a pilot study was conducted and the questionnaire was finalised in accordance with expert opinion and advice. Data collection is still in progress in alliance universities; when it is finalised, the participant responses will be statistically analysed and the results will be reported. Recommendations will be made based on the findings of the research.





## IMPLEMENTING EELISA – SUSTAINABLE BCC COMMUNITY ACTIVITIES APPROACH

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**Conference Topic:** The University of the future

**Key words :** Activities Development, Work Strategy, Network, Strategy, facilitation.

### ABSTRACT

EELISA Community SUSTAINABLE BCC “Technical and Social Challenges for Sustainable Buildings, Cities and Communities” mission is to promote a European university ecosystem that exploits synergies to innovate, educate, and raise awareness to boost the challenge of building more sustainable, efficient, and carbon-neutral buildings, cities, and communities.

SUSBCC Community is based on three pillars: innovation through research, awareness through work in contact with society challenges and education. SUSBCC community proposes to:

Take advantage of the dynamism and creativity of European university students to stimulate the technical and social transition towards more efficient and sustainable cities and communities.

- Explore and exploit synergies between cross-cutting technical and social branches.
- Integrate companies and professionals, researchers, students, and other citizens into the Ecosystems.

To achieve this SUSBCC Community has designed a Work Strategy, which consists of the coordination and integration of four areas: Partners Network, International EELISA Network, Activities Development and Communication Plan.



The work presented here is related to the structure and results of the Activities Development Area, considering that the four areas are integrated, so the Activities Development Area leans on Partners Network, International EELISA Network and Communication.

The strategy of SUSTAINABLE BCC Community regarding the Activities Development Area has been to facilitate the organization of two kinds of activities: bottom-up and top-down.

**BOTTOM-UP Initiatives:** Motivating the professors to propose any activity they are able to implement in their educational environment, going further from their comfort zone exploring active learning using any of the innovative education methodologies: challenge learning, learning by doing, project-based learning, collaborative learning, service learning...etc.

The premise is “learning NOT studying BUT imagining, creating, solving, doing, exploring, participating...etc.”

The objective of proposing this kind of activities is to provide short term results to participants, promoting the beginning of EELISA, working on and testing new educational approaches integrated in the existing curricula, as well as getting education community to know and understand EELISA Alliance. So, it has been a path achievable for all professors individually, with constant support from SUSTAINABLE BCC Coordination.

Some examples of the bottom-up activities are:

- Voluntary tasks related to sustainability in the bachelors or master courses like “Sustainable precertification of a project”, “Exploring innovative sustainable solutions in the building systems design”, “Implementing innovative building façade elements”, etc.
- Final Degree Projects related to Sustainability Challenges.
- Participation in research project “Monitoring of the citizens response to urban stimuli”.
- EELISA
- Co-design workshop for students, aiming at having students input on EELISA’s future.
- Optional workshop like “Solar Decathlon Workshop”
- Participation in Summers Schools.
- Two Service Learning Projects.
- Participation in Architecture Competitions “*Mi diploma descarbonizado*” and “INTBAU”

From the beginning of EELISA until June 2023 SUSBCC Community has organized 45 bottom-up activities participating 310 students.

**TOP-DOWN Projects:** These kinds of activities are the main ambition from SUSTAINABLE BCC Coordination and are directly link with EELISA Alliance goals, seeking to connect Education, Research, Innovation, and public debate, improving the link between Engineering and Society. The objective of the Top-down activities approach is to carry out in the near future pilots of innovative, active, interdisciplinary and international teaching activities connected with society challenges.

To carry out these activities the SUSTAINABLE BCC Community structure needed to be created and needed to be solid. The coordination and integration work in the areas of Partners Network



and International EELISA Network were key drivers to implement the TOP-DOWN Projects in 2023.

The international multidisciplinary activities were a Think Tank on Sustainable Buildings held in Madrid in January 2023 and a Proptech Entrepreneurship Hackathon held in Madrid in June 2023 where 130 students, 126 professors and 32 professionals participated.

The Think Tank on Sustainable Buildings was organized by the European Space Agency (European Space Astronomy Centre) and the EELISA Community SUSTAINABLE BCC (Sustainable Buildings, Cities, and Communities). It was an educational activity to promote innovation and to generate fresh ideas to launch a comprehensive sustainable retrofitting of the European Space Agency (ESA) in Spain.

After the successful “Think Tank on Sustainable Buildings” and due to the relationships established with professors of BME, ITU, PSL a joint activity was proposed. The educational project was designed as a Hackathon in which students, grouped in international work teams (future start-ups) participated in a condensed Proptech Entrepreneurship Programme.

SUSTAINABLE BCC Community has created a momentum and many initiatives are being proposed both in the BOTTOM-UP and in the TOP-DOWN areas, it has been a challenge to reach students and professors, it has been a challenge to work in an undefined path. After three years of work EELISA Alliance future seems to be better understood and less uncertain with every step we take.



## SSERIES community: Interdisciplinary Science in EELISA

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**Conference Topic:** The University of the future.

**Key words :** science, interdisciplinary, arts, citizen science, sustainability, communities of practice.

### ABSTRACT

Imagine the University of the future... ‘unus’ and ‘versus’, the whole that revolves around a center, a ‘cosmos’ of knowledge and research spinning around you during years.

And why are we now at the University? Because we all want to be useful, to generate solutions, to overcome the challenges we face. Maybe these are the same reasons that moved Fatima al-Fihri -an emigrant arrived in Fez, Morocco, in 9th century- to build a place where people could be educated as she and her sister had received a good education in their home region of Kairouan, belonging to the actual Tunisia. This place was Al-Karaouine, considered one of the oldest universities in the world.

Our societal challenges are now global, increasingly complex, affecting many areas and requiring interdisciplinary teams. In EELISA community SSERIES –Science for Sustainably Envisioning Reality and Information for an Engaged Society [1]- based in Universidad Politécnica de Madrid, we would like to use science as a ‘trans-versal’ instrument to achieve a sustainable world, enriching scientific culture with arts, promoting citizen science and applying critical thinking to combat disinformation.

We choose here some activities of the EELISA community SSERIES as our case to study and formulate some hypotheses about the University of the future.



Let's start by posing questions: Will we be able to sum up ideas to reduce inequalities by improving education? Is it possible to let citizens be part of science? Why don't we build an enriched culture that mingles sciences and arts? How to generate solutions to optimization problems making our world sustainable? Can we inoculate ourselves against disinformation?

SSERIES provides us with interesting data to analyze, including the following:

Every academic course, in 'π-ensa Mathematics Workshop-Museum Classroom', coordinated by Mariló López, university students collaborate to offer a space where high school centers and general public enjoy playing with Mathematics and testing their skills.

During Art & Science contest, coordinated also by Mariló López and inspired by the activity initiated by National Institute of Nuclear Physics (Italy) and CERN, secondary school student teams mentored by university students, present a creation where a scientific concept is analyzed using art as a conveying instrument.

In Citizen LAB ExperimentaMates, coordinated by María Barbero and promoted by the R&D Agency of the Region of Madrid, citizens concerned about sustainability or education (promoters) present their favorite problems, for instance, how to design aesthetical acoustic panels using recycled paper? or could we know what is the footprint produced by our diet? Then, those people interested in the project presented by the promoter make a team to find a solution. Finally, all together put their ideas in action, prototyping solutions at the production workshop.

In response to disinformation phenomenon that hinders sustainable development, a team coordinated by aría-Jesús Vázquez drives a crowdsourcing process where university students feed news into a database of true, half-true, misleading and false news, with their veracity checked by means of a reliable source.

Moreover, in a playful way, an international championship is held where some news from the database are presented to the participants and people have to guess the veracity of the news, giving a social net style explanation of their guess.

An international Research Based Learning activity is coordinated by Andrea Tellini, where groups of Math students supervised by faculty members work online on a project –for instance, dynamics of populations affected by climate change- regarding how mathematical approaches can help to progress in some SDG, with final face-to-face presentations of the projects.

We think that these kind of activities stimulate creative ways to disseminate science and contribute to develop mentoring/group leading skills for university students; they turn citizens into actors of science; they increase awareness about disinformation and they take advantage of mathematics in favor of sustainability.

Yes, this case tells us that in EELISA, our European University, we can engineer communities of practice [2] where many disciplines come together and where diverse people connect their minds: what better way to prepare ourselves to solve future real-world problems.

[1] <https://community.eelisa.eu/communities/sseries-science-for-a-sustainable-environment-of-reality-and-information-for-an-engaged-society/>

[2] *Communities of practice. Learning, meaning and Identity*. E. Wenger. Cambridge University Press, 1998.

# 6th October, 2023

11:30 -13:00

Engineering Education: developing future proof skills

Chair of the session: José Carlos Quadrado, ENAEE President

📍 Aula Conference Centre - Room 2.1

- P.78** • The design of Engineer Profile in EELISA Alliance by **Morris Villaroel (UPM)** and **Sophie Griveau (PSL)**
- P.82** • Development of an evaluation tool of the acquisition of social, citizenship and sustainability competences in circle and EELISA Circular Experiences. Case Study on UPM Athens 127 Course by **Beatriz Martin Bautista Cerro (UPM)**
- P.85** • EELISA Mobility Scheme for Chimie Paris-Tech PLS Engineers by **Antoine Mercier (PSL)**
- P.87** • Integration of satellite image time series and field work for the metropolitan forest (Madrid) by **Silvia Merino De Miguel (UPM)**



## THE DESIGN OF ENGINEER PROFILE IN EELISA ALLIANCE

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**Conference Topic:** Engineering education

**Key words :** Engineering education, competences, sustainability, transversal skills, European values.





## ABSTRACT

### *Context*

The world needs more engineers and Europe provides a rich and diverse environment to train them. Engineers face new challenges in a global society where multiple professional practices can be required to tackle global issues, while respecting local specificities. All this requires mastering a new skill set or gamut of competences that are not always clearly defined.

EELISA European university is a European University Alliance centered around engineering and innovation education. In this context, we aimed to develop a profile for a European engineer since this framework can also be used to create European joint degrees and attract and host more international students, improving prestige and moving towards a European label. The idea is for the profile to include the attributes, skills, lived experience and attitudes that make a graduate in engineering most adapted to the needs of employers, to help students be more prepared to conduct his/her professional activity within a sphere of certain values and with a clear knowledge of societal challenges and goals.

### *Methodology*

Most universities provide excellent scientific and technical knowledge to train engineers, but there is more debate about how to educate students in more transversal skills, such as values like ethics, sustainability and interculturalism, so as to train them to manage and innovate in front of complex problems once working in national and/or international companies.

Within the context of the European Universities Initiative and increasing collaboration with industry,

it has become increasingly important to define and to be able to compare university studies in terms of an overall engineering profile 1-4. In terms of future joint degrees, where students will move from their home institution to study in one or more different EU countries, several universities must agree on basic requisites for fundamental and transversal skills to be able to create and compare study programs. A definition of course requirements for different degrees may be fairly straight forward, but less work has been done to help define the requirements for transversal skills. Indeed, training can involve mastering technical disciplines and science-based processes and phenomena, as well as transversal skills to help integrate technical, environmental, and social dimensions.

Our methodology to conceptualize the EELISA engineer profile was based on (i) on-line survey for students and staff of partner universities (75 respondents) (ii) in-depth interviews with relevant stakeholders in senior positions in European companies and (iii) the in-depth analysis of the literature and of standards from Engineering accreditation agencies at European and worldwide level 5-7.



The results from the survey show an interest in obtaining a European degree/certification. The results show the importance of the adaptability to current and future real-life changes and the ability to analyse complex problems, and design innovative solutions by mastering skills in science and technic. The survey highlights the importance in ethics, analysis of societal and environmental impact of developed solutions. Business and intercultural competences are also part of skills to be developed for engineers.

The results from the in-depth interviews suggest that the specialized knowledge of current engineer graduates in Europe is excellent and should be maintained at a high level, including basic science skills. Additional skills in sustainability, interculturality, business and social skills would be appreciated. Most respondents found it difficult to predict the qualities required of engineers in the future, mostly due to uncertainties related to technological change.

### *EELISA engineer profile*

On the basis of the findings in this work, we propose four main pillars for a European engineer profile : 1) Scientific and theoretical knowledge including digital skills, 2) Addressing sustainability, 3) Interculturalism: an engineer embracing the European project, and 4) Business and communication skills: practical and applied knowledge.

Indeed, given the uncertainty and complexity of real world challenges for society, while applying the theoretical and practical knowledge they obtained, engineers will need to consider social objectives, and ethical responsibilities in addition to sustainability issues. Because they are at the interface between science, techniques and society, engineers will also require training related to communication skills, decision-making and independent learning to better integrate the views of multiple stakeholders into their decision and creative processes. These skills are best learnt in real contexts, in which students, having acquired basic principles, put them into practice in actual multi-lingual, multi-cultural and inter-disciplinary contexts. Given the fast evolving technological and societal environment, the European engineer needs to adopt a position of continuous learning that will maintain his/her ability to address societal and technological challenges.

### *Conclusion*

The EELISA engineer profile can be created by a combination of different life experiences, acquired knowledge, exposure to the real and changing world problems, constraints and social context, mindful of the ethical consequences of the engineering solutions and trained to understand and communicate with other professionals, in diverse cultures and environments. It's sound education and training makes the EELISA engineer profile more flexible to adapt to a quickly changing context and enables students to learn by themselves.



## Acknowledgements

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## DEVELOPMENT OF AN EVALUATION TOOL OF THE ACQUISITION OF SOCIAL, CITIZENSHIP AND SUSTAINABILITY COMPETENCES IN CIRCLE AND EELISA CIRCULAR EXPERIENCES. CASE STUDY ON UPM ATHENS 127 COURSE.

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**Conference Topic:** The University of the future.

**Key words:** social competences, citizenship competences, GreenComp, sustainability, competences assessment.

### ABSTRACT

The evolution of the linear economy model to a circular one is crucial to reduce pressure on the environment and ensure a sustainable future, which is why more and more sectors in which it is applied<sup>1</sup>. Implementing the circular economy requires an innovative mindset, which allows solving dilemmas from a holistic and creative perspective in order to relate each of the multiple dimensions that make up the circular economy<sup>2</sup>. In this context, the Circular & Socio-Civic Virtual Learning Hub (CIRCLE) project has been created, "CIRCLE empowers the new generations of professionals working in a circular transition with a socio-citizen commitment"<sup>3</sup>. The CIRCLE Virtual Hub is a meeting point where students, education professionals, experts from all disciplines and stakeholders, collaborate to solve challenges committed to society, citizenship and the circular economy<sup>3</sup>. This space of creativity is intended for students and other interested parties to reflect on the many challenges posed by the world in which we live, considering their social and civic implications. From this approach, students become an active part of the shift towards a circular transition, while applying the technical principles learned throughout their teaching. The CIRCLE Virtual Hub act as a platform and repository of knowledge, creating a point of mutual learning and in which any citizen can be nourished by the knowledge shared there.



Through its educational objectives, the CIRCLE project is committed to promoting the concept of European Engineer, defined by the European Engineering Learning Innovation and Science Alliance (EELISA), as one who combines technical knowledge with social impact<sup>4</sup>. EELISA, the first alliance of Higher Education Institutions (graduate engineering schools, technology universities and full-spectrum universities) from different countries in Europe, understands the future as one in which Society is able to face the challenges of the situation through intelligent solutions developed through sustainability by this model of European Engineer<sup>4</sup>. In order for this circular future to be real, people, in particular young people, need to acquire transversal competences<sup>5</sup>. The importance of receiving competency-based education focuses on the ability to meet the ever-changing needs of students, education professionals, jobs and society at large, ensuring that learning content is properly integrated<sup>6</sup>. To work on solving the dilemmas of the 21st century from a socio-citizen perspective, CIRCLE has chosen the citizenship key competences and the personal, social and learning to learn key competences from the recommendation on key competences for lifelong learning of 2018, defined by the European Higher Education Area (EHEA) and the Council of the European Union<sup>7</sup>. On the other hand, since the circular economy must be developed through sustainability, the framework of European competences in sustainability or GreenComp from the European Commission, has been included<sup>8</sup>. The CIRCLE project unites citizenship competences, social, personal and learning to learn competences and the GreenComp in a single theoretical and application framework which has been named SOCg competences. From this point, SOCg competencies are used by both CIRCLE and EELISA to create Circular Experiences. Assessing the growth and development in transversal competences is a complex but necessary task, which guarantees the true learning of the educational and training contents proposed in the curricula<sup>9</sup>. In the absence of a validated European assessment tool in transversal competences to use<sup>10</sup>, CIRCLE and EELISA are faced with the need to develop a tool capable of assessing growth in SOCg competences. Therefore, as the main objective of the study it has been proposed to develop a tool that allows education professionals and European university alliances to evaluate the growth in competences within educational and training programs. The specific objective of the study was to analyze the adequacy of the course UPM ATHENS 127 "The Basics of Circular Economy in the Construction Sector context: transforming wastes into resources, offered by the research group of Sustainability in Construction and Industry (UPM-giSCI) of Universidad Politécnica de Madrid (UPM) and the EELISA Circular Community, in collaboration with the CIRCLE project. The ATHENS course took place from March 13 to 17, 2023 at UPM, and it was attended by 19 students from multiple countries such as France, Greece, Italy, Portugal, Belgium, Germany, Nigeria, Turkey, etc. The tool consists of a self-assessment questionnaire in SOCg competencies, in which the participant must reflect on the level of development he has experienced in each of the competencies individually.



After reflection, the participants completed the questionnaire according to your criteria, scoring with values from 1 to 5 (1 being the lowest value and 5 the highest value) which has been the perception of their growth.

The results show growth in SOCG competences in all participants after completing the UPM ATHENS 127 course, demonstrating the effectiveness of the educational program not only in the acquisition of the technical knowledge taught, but also in the capacity for training in SOCG competences.

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## EELISA MOBILITY SCHEME FOR CHIMIE PARISTECH PSL ENGINEERS

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**Conference Topic:** Engineering education

**Key words :** Mobility, Internship, Studies, Businesses, Citizenship.

### ABSTRACT

Within Université PSL, the engineering students of Chimie ParisTech PSL used to do a mobility of internship during the 2nd year of engineering which corresponds to a level of 1st year of Master's degree in the Bologna process. Indeed approx. 80% of them move abroad whether in academia or in businesses. The remaining 20% do a mobility of studies during the 3rd year of engineering (equivalent to the 2nd year of a Master degree). While the attractiveness of our partners was not challenged, we realized that the vast majority of students prefer going abroad during the 2nd year to be sure to remain in the school during the last year of studies.

Given this situation, the international office of Chimie ParisTech PSL considered that there was a lack of opportunity for students to experience the student life abroad. We consider that studying in another university brings a wider experience than doing solely an internship. Indeed, by studying, students can experience other culture of teaching, they can also be in contact with a wider diversity of nationalities and cultures that will be the nucleus for their European professional networks and European citizenship. They can also find original courses that are not offered in the school.

To do so and thanks to EELISA that brings a safe testbed to new initiatives, together with the Dean of studies of the school we suggested to open up the full 2nd semester of the 2nd year of engineering to mobilities that are composed of 18 ECTS of courses and 12 ECTS of internship.

It means that student would get a "double exposure" of EELISA partners by being both student and intern in a laboratory. In addition, the duration of the mobility is greater leading to more opportunities to discover the hosting country and/or participating in local EELISA activities. The different rules have been changed during 2022 to enable this opportunity.

Starting a new scheme is challenging and despite long discussions we were not sure that students would choose it. In May 2022 we made the first presentation, and several professors were volunteer to coach the students in case they have issued in preparing their project. Over 100 students, 10 were at the beginning interested and finally 4 of them went to 3 different EELISA members (SSSA, FAU and UPM). The current students did choose original courses from partner and sometimes in the language of the host institution which reinforces the cultural experience. For the second intake, we hope to send more students (6 to 8) in different EELISA members.





Based on this first experience, we would like to share with all, we think about developing it further. Indeed, while we would target more students and advocate the added value of this scheme in other degrees, we would like to offer the possibility of an internship in a business. With this scheme we would be at the crossroad of key issues that are discussed in EELISA: reinforcing student experience, their employability, our links with business, our capacity to train European engineers by tweaking the classical Erasmus mobility scheme...



## INTEGRATION OF SATELLITE IMAGE TIME SERIES AND FIELD WORK FOR THE METROPOLITAN FOREST (MADRID)

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**Conference Topic:** Engineering education.

**Key words:** Sustainable development, Remote Sensing, Earth Observation, Metropolitan Forest.

### ABSTRACT

Considering the latest technological development of the Remote Sensing domain, Satellite Image Time Series (SITS) analysis is nowadays used at large scale in applications related to land cover and land use, urban growth, forestry monitoring, surveillance and so on.

Combining multi-source SITS data with aerial observations (e.g., using unmanned aerial vehicles) and in situ measurements allows an enhanced resource management towards a sustainable development of environment in the context of mitigating the climate change effects. In the EELISA Green Planet Community, we aim at preserving our green resources using intelligent technologies (e.g., SITS, AI).

During the “Fusion of Satellite Image Time Series and Multimodal Data for Urban and Forestry Sustainable Development” workshop that took place in Bucharest, between 15th-17th February 2023, SITS data collection (e.g., through the Copernicus Program which represents the European Union's flagship Earth Observation initiative) and concepts related to SITS data interpretation have been discussed. In this context, urban and forestry data collection and management have been presented under the larger framework of “Metropolitan Forest” and the “Producers Neighborhood” projects financed by the Madrid City Council [1].



Wildfires have an important impact over forestry preservation. For this reason, developing methods and techniques for fire detection plays an important role in safety monitoring, firefighting, and fire-spread forecasting [2].

Considering the heterogeneity of data collected by satellites, multimodal change detection represents one of the main challenges related to bitemporal data analysis. Despite the numerous advantages of using multimodal data for monitoring (e.g., enhanced temporal resolution, continuous monitoring, data complementarity), the main challenges reside in analyzing data that is acquired by sensors characterized by different physical characteristics (optical / SAR), different spatial and spectral resolutions, and different statistical properties. One of the most straightforward solutions is to translate modalities and perform pixel-wise difference to highlight the changes between the two temporal moments. With the current advances in deep learning, models based on generative adversarial neural network architectures can be designed to perform modality-to-modality translations (i.e., from pre-event to post-event modality and vice versa), even under change conditions [3]. The applications are numerous and range from monitoring lake overflow to monitoring urban development. Inter-modality translation can be also extended for multimodal SITS analysis. Once the multisource images are projected in the same modality, the analysis of multimodal SITS reduces to the interpretation of single-modality SITS. This is convenient since common SITS analysis techniques (e.g., Dynamic Time Warping, matrix profile) can be used to identify patterns in the time series, and even, anomalies [4].

During the “Creation and start-up of a Multidisciplinary Territorial Information System for the proposal of activities within the framework of the projects: “Bosque Metropolitano” (Metropolitan Forest) and “Barrios Productores” (Producer Neighborhoods) (Madrid City Council” seminar that took place in Madrid, between 24th-28th April 2023, we worked on the design and construction of a territorial information system for the Madrid City Council. For getting this propose, a multi-user database was created in GIS using ArcGIS OnLine, ArcGIS Field Data, and ArcGIS Field Data Designer. Different layers were added on the physical, biotic, and administrative characteristics of the territory to support field data collection and understanding of the study area. An application for data collection in field using mobile phones was customized. This database allowed the integration of results from the remote sensing images processing, together with the information captured during the field trips. Once finished, the database will be used to support any activity that is carried out within the Metropolitan Forest supporting the City Council in the making decisions process.

[1] Online, <https://blogs.upm.es/eelisa-greenplanet/>

[2] A. Enis Çetin, Bart Merci, Osman Günay, Behçet Uğur Töreyn, Steven Verstockt, Chapter 4 - Multisensor Fire Analysis, Editor(s): A. Enis Çetin, Bart Merci, Osman Günay, Behçet Uğur Töreyn, Steven Verstockt, *Methods and Techniques for Fire Detection*, Academic Press, 2016, Pages 61- 82, ISBN 9780128023990, <https://doi.org/10.1016/B978-0-12-802399-0.00004-1>.

[3] A. Radoi, "Generative Adversarial Networks Under CutMix Transformations for Multimodal Change Detection," in *IEEE Geoscience and Remote Sensing Letters*, vol. 19, pp. 1-5, 2022, Art no. 2506905, doi: 10.1109/LGRS.2022.3201003.

[4] Radoi, A. Multimodal Satellite Image Time Series Analysis Using GAN-Based Domain Translation and Matrix Profile. *Remote Sens.* 2022, 14, 3734. <https://doi.org/10.3390/rs14153734>

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