



## PRÁCTICAS DOCENTES EN LA COMPETENCIA DE TRABAJO EN EQUIPO

### XII SEMINARIO DE INNOVACIÓN Y BUENAS PRÁCTICAS DOCENTES DE LA EINA

#### MESA 1.

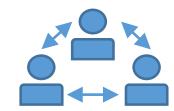
- Jesús Arauzo/Javier Remón. “Promoviendo una educación multicultural e interdisciplinar: Químicos Británicos e Ingenieros Químicos Españoles trabajando juntos en nuevos procesos de biorrefinería sostenible”.
- David Ranz Angulo. “Potenciación de la metodología de aprendizaje basado en proyectos interdisciplinares mediante la incorporación de herramientas de gestión de equipos”.
- Angel Antonio Bayod. “Desarrollo y aplicación de metodologías de trabajo en equipo en el contexto de la Energía Solar Fotovoltaica y la implantación de un sistema de evaluación de pares de la contribución individual para el trabajo en grupo”.
- Eva María Llera Sastresa “Comunicar y colaborar. Mejora de competencias transversales en estudiantes de ingeniería.”

#### MESA 2.

- Anna María Biedermann. “Apoyo al ecosistema de emprendimiento zaragozano – Ayuntamiento de Zaragoza (Zaragoza Activa) y Vicerrectorado de Transferencia e Innovación Tecnológica (Ceminem) a través de una actividad de diseño de identidad corporativa realizada por los estudiantes”.
- Inmaculada Arauzo Pelet. “Trabajos grupales basados en visitas a empresas en la asignatura Tecnología Energética del Master Universitario en Ingeniería Industrial”.
- Javier Blasco Alberto: "Aplicación de Aprendizaje Basado en Problemas en cuatro asignaturas del segundo curso del Grado de Ingeniería Química".
- Francisco Brosed. “Diseño y planificación coordinada de actividades formativas asociadas a los resultados de aprendizaje “comunicación y el trabajo en equipo” en el Grado en Ingeniería Mecánica”.

#### **Estado del arte de la competencia Trabajo en Equipo en la UZ.**

A cargo de: Iván Lidón. Coordinador del Grado en Ingeniería de Diseño Industrial y Desarrollo de Producto. Miembro del observatorio de competencias del ICE.

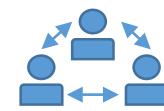


**“Promoviendo una educación multicultural e interdisciplinar: Químicos  
Británicos e Ingenieros Químicos Españoles trabajando juntos en  
nuevos procesos de biorrefinería sostenible”**

**“Towards a multicultural and global education via international co-operation: British  
Chemists working with Spanish Chemical Engineers on new bio-refinery concepts”**

**Javier Remón, Glenn H. Hurst and Jesús Arauzo**

A collaboration activity between British chemistry students from the University of York and Spanish MSc Chemical Engineering students at the EINA, enrolled on the optative subject “Waste valorisation. Biorefineries” (Valorización de Residuos. Biorefinería, 66239)



## In-demand skills for hiring new professionals



Co-operative work

+



Multicultural and  
Multidisciplinary environments



many students lack the sociocultural  
skills necessary to develop projects  
where these social aspects prevail

We need develop new international pedagogical activities ...

### Chemical Engineering

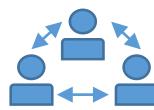


British Chemists + Spanish Chemical Engineers working  
together on new bio-refinery concepts



Multiculturalism

Multidisciplinary  
activities



## International UoY- UNIZAR project

4 International pairs:

One British Chemist student (University of York, UK) and one Spanish Chemical Engineer student (University of Zaragoza, Spain)

4 Bio-refinery projects:

- Citric waste valorisation.
- Crude glycerol upgrading
- + Marine plastic pollution remediation
- Cooking/automotive oil upgrading

1. Exchange e-mails

3. Posting project progress on social media (Twitter)



A poster presentation to be posted on Twitter

Two Flash presentations of the poster (English and Spanish)

## Work assessments and anonymous open-ended questionnaire



VALORISATION OF CITRIC WASTE VIA MUCONIC ACID AND GASIFICATION

Cite: Wilson and Rothery, 2014  
University of York, Zaragoza  
University of Zaragoza

THE WASTE VALORISATION OF CRUDE GLYCEROL FROM THE PRODUCTION OF BIODIESEL

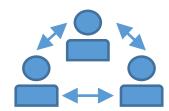
University of York, Zaragoza, University of Zaragoza, University of Zaragoza

The Valorisation of Marine Plastic Waste

Katie Stott, Department of Chemistry, University of York

Biorefineries: Valorisation of Used Cooking Oil

Mariy K. Serrano, I. University of Zaragoza



## Twitter accounts created by the students



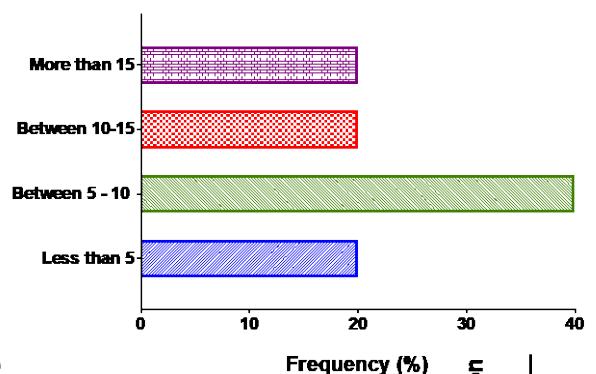
**3 out of 4 groups created a bespoke twitter account**  
**50 % Twitter user. 50% no Twitter users.**

- Easier to be managed by both members
- Anonymous
- More professional to increase project visibility in social media

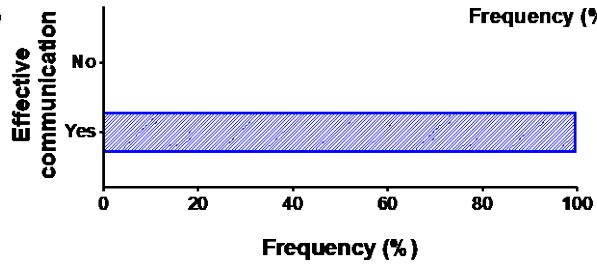
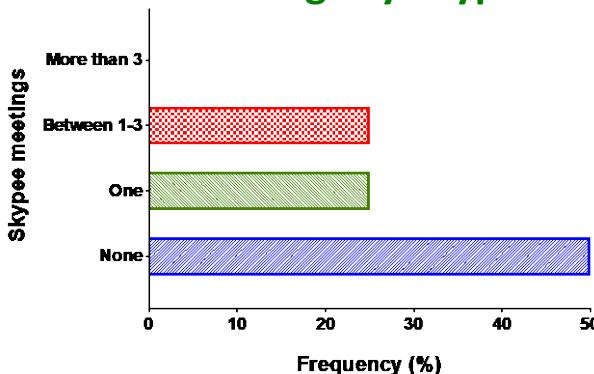
- 4 groups uploaded the poster
- 1 student posted their presentation

## Students interaction over the project

### Communication via e-mail

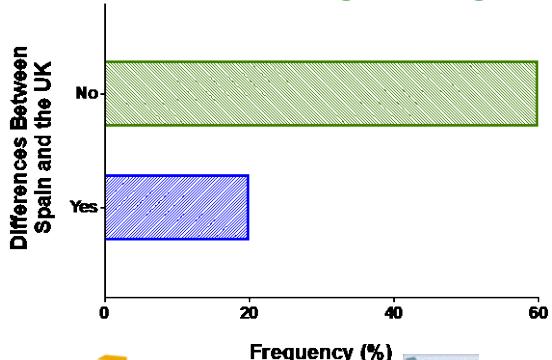


### Virtual meetings by Skype

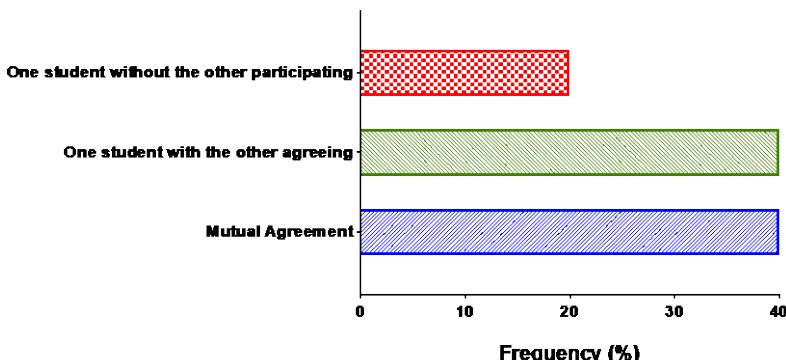


## Students feedback

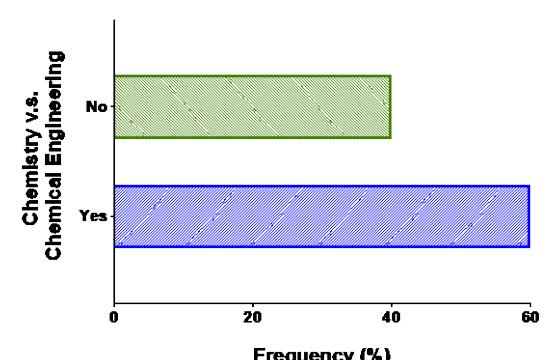
### Differences in organising the labour



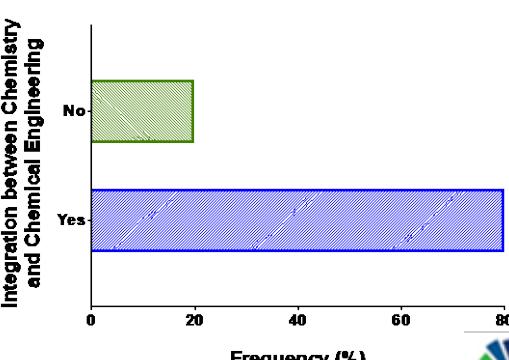
### Decision making process

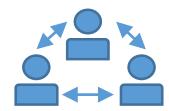


### Education differences



### Multidisciplinarity





## Concluding remarks: teaching good practices

1. This co-operative project has helped the students transition from a reductionist understanding of their discipline to a holistic deep understanding of a bio-refinery concept, which is more integrated.
2. Working in international pairs increased the awareness of students about the existence of intrinsic sociocultural differences between them, largely related to language and culture. Furthermore, students realised that collaborative work is not done similarly all around the world.
3. The integration between Chemistry and Chemical Engineering helped students to be mindful about how a problem can be solved from different, but complementary, perspectives. This not only helped to promote peer-learning, increasing students' motivation, but also contributed towards the development of a global and multicultural education.



# POTENCIACIÓN DE LA METODOLOGÍA DE APRENDIZAJE BASADO EN PROYECTOS INTERDISCIPLINARES MEDIANTE LA INCORPORACIÓN DE HERRAMIENTAS DE GESTIÓN DE EQUIPOS.

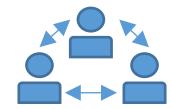
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STRENGTHENING THE LEARNING METHODOLOGY BASED ON INTERDISCIPLINARY  
PROJECTS THROUGH THE INCORPORATION OF TEAM MANAGEMENT TOOLS.

**4º curso Grado en Ingeniería de Diseño y Desarrollo de Producto (Taller de diseño VI: Práctica Profesional)**

**4º curso Grado en Ingeniería Electrónica y Automática (Laboratorio de Diseño Electrónico)**

David Ranz Angulo, Eduardo Manchado, Manuel Torres Portero, Carlos Romero Piqueras, Jorge Sierra Pérez  
Roberto Casas Nebra, José María López Pérez

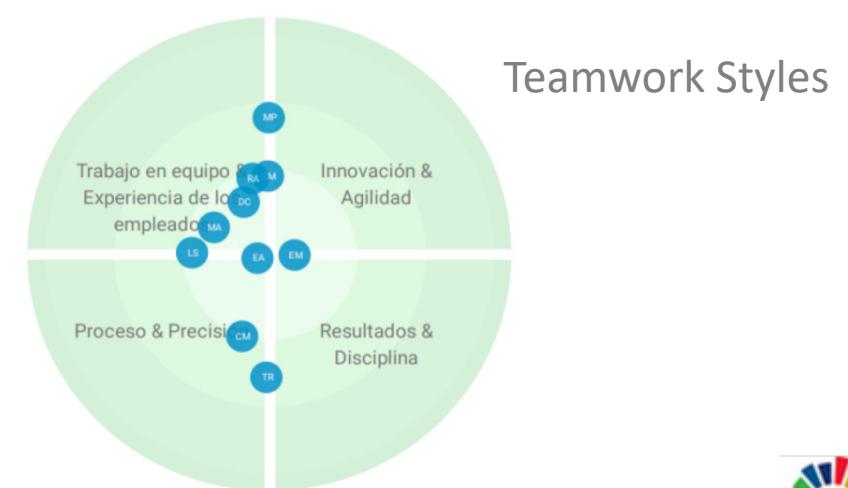


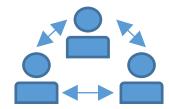
## BACKGROUND

- Design workshops ideal environment for application of the PBL. Competence and learning outcome in GD.
- Last year students close to the labour market. Interdisciplinary teams.
- Experience started in 2006 with the Degree in Electronics.
- Incorporation of the BSH company to the project in 2014.
- Innovation in course 2019-2020: Use Teamwork Management Tool



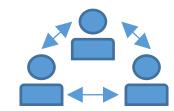
Individual Behavioral Drives





## EXPERIENCE PROCESS

- "Random" teams made up of 3 Designers + 1 Electronic
- Express Project (**team start-up**) + Main project
- **Team regulation** (working methods, team rules, corrective measures...)
- Result of the **Predictive Index**.
- Modifications in the team strategy and rules if considered necessary.
- **Main project: Development of an innovative product.** (Company framework)
- **Mentoring** by the group of teachers and the company (process + result)
- **Evaluation by rubric**.
- **Common marks** to all team members. (Project team assessment sheet).



## GOOD PRACTICES

- Random teams
- Team knowledge dynamics.
- Real projects.
- Encourage the participation of all disciplines in group sessions.

## TEACHING STAFF TRAINING/SKILLS

- Acquired through 14 years of experience development.
- Teamwork as professional development tool



# Application of teamwork methodologies in the context of Photovoltaic Solar Energy and the implementation of a peer evaluation system of individual contribution to group work (IPAC)

Desarrollo y aplicación de metodologías de trabajo en equipo en el contexto de la Energía Solar Fotovoltaica y la implantación de un sistema de evaluación de pares de la contribución individual para el trabajo en grupo

Ángel Antonio Bayod-Rújula, Amaya Martínez-Gracia,  
Juan Bautista Arroyo-García, Antonio Joaquín Montañés-Espinosa

XII SEMINARIO DE INNOVACIÓN Y BUENAS PRÁCTICAS DOCENTES DE LA EINA  
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# Trabajo en equipo

- La capacidad de saber colaborar con los otros para contribuir en un proyecto común se considera una competencia clave
- Beneficios trabajo de grupo
  - Pensamiento crítico
  - Mejora de habilidades de comunicación
  - Fomento actitudes positivas

- By cooperation students work together to achieve shared objectives. Individual and group beneficial results are obtained. Among the cognitive benefits are the promotion of critical thinking and the enhancement of communication skills. Besides, it promotes the appearance of positive attitudes towards the learning process.



# Problema de la evaluación individual

- Una forma de abordar este desafío es utilizar la evaluación de pares de la contribución individual para el trabajo en grupo, que se puede denominar, por sus siglas en inglés, IPAC (Peer Assessment of Individual Contribution to group work).
- An interesting topic is the problem of the individualized assessment required for each student.
- Each student has different abilities, dedication and motivation, so their contribution to group work can be very different.
- Both teachers and students conceptually reject that all members of the group get the same marks regardless of their contribution.
- One way to address this challenge is to use the peer assessment of individual contribution to group work, which can be referred to as IPAC (Peer Assessment of Individual Contribution to group work)



- Se ha aplicado a la parte de Energía Solar Fotovoltaica dentro de la asignatura obligatoria Energía Solar y de la Biomasa, del Master en Energías Renovables y Eficiencia Energética.



- Results of applying teamwork methodologies in the context of Photovoltaic Solar Energy, within the compulsory subject entitled “Solar Energy and Biomass” of the Master in Renewable Energies and Energy Efficiency of the University of Zaragoza (Spain) and the implementation of a peer evaluation system for the individual contribution for a better assessment of the students.

## Evaluación por pares. Contribuciones individuales al trabajo grupal

- Se han desarrollado preguntas para cada alumno
- Evalúan a otros grupos, a otros compañeros de su grupo y su propia contribución
- A series of questions have been developed for students at the end of the teamwork presentation period. Each student evaluates the other groups in the class, the other classmates in their group and their own contribution.
- The results of this evaluation process, which will be presented here, were widely accepted by the students and the teacher.



- Cuestiones generales
- Preguntas abiertas
- Calificación individual de cada compañero de grupo
- Calificación de la presentación en clase de los compañeros de su grupo y los otros grupos.

*Escribe tus comentarios de manera profesional y constructiva,  
ya que estos quizá serán vistos por sus compañeros después,  
aunque los comentaristas permanecerán anónimos.  
¡También debes evaluarte a tí mismo!*



# Cuestiones generales

- Motivación
- Cohesión
- Coordinación
- Ventaja trabajo en grupo
- Esfuerzo comparativo
- Percepción del resultado final
- Dinámica de toma de decisiones
- Logros conseguidos



# Calificación individual

- Esfuerzo dedicado
- Capacidad de trabajo en equipo
- Liderazgo
- Cumplimiento tarea
- Visión general
- Contribución (%) al resultado final



# Resultado

	Grupo A	La presentación tenía contenidos valiosos, novedosos, interesantes	4,45	4,39	4 4 4 4 4 5 5 5 4 4 4 5 5 5 5 5 4 4 4 4 5 5 5 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4
7,77	3,93	La presentación estaba bien organizada y era fácil de seguir	4,14	4,11	4 4 4 4 4 4 5 5 5 4 4 4 5 5 4 5 4 4 3 4 4 5 4 4 3 5 4 3 4 4 4 5 3 3 4 3 4 4 4 4 4 4
		Los presentadores exponían el tema con claridad	4,18	4,18	4 4 4 4 4 5 5 5 4 4 5 5 4 5 4 4 4 5 4 5 3 4 4 4 5 3 3 4 3 4 4 5 3 3 4 3 5
		Los presentadores trataban de involucrar a la audiencia	2,77	3,04	4 4 4 4 4 4 3 1 3 4 5 1 1 3 2 1 1 1 4 3 4 4 5 3 4 3 1 4
	Grupo B	La presentación tenía contenidos valiosos, novedosos, interesantes	4,06	4,25	4 4 4 4 4 5 5 5 5 5 5 5 5 3 4 5 5 3 3 4 5 4 5 4 5 4 5 3 3 4 3 4 3 4 3 4
7,91	4,09	La presentación estaba bien organizada y era fácil de seguir	4,00	4,11	4 4 4 4 4 5 5 4 5 4 4 4 4 4 5 4 3 3 3 5 3 5 4 5 4 4 4 4 4 4 4 4 4 4 4 4 4
		Los presentadores exponían el tema con claridad	3,65	3,89	4 4 4 3 4 5 5 5 5 4 4 3 4 4 2 3 4 2 5 3 5 4 5 5 3 3 3 4 3 4 5 3 3 3 4
		Los presentadores trataban de involucrar a la audiencia	4,12	4,11	4 3 3 4 4 5 4 3 5 5 5 5 4 5 2 1 4 4 5 5 5 5 5 5 3 4 4 4 4 4 4 4 4 4 4 4 4
	Grupo C	La presentación tenía contenidos valiosos, novedosos, interesantes	3,93	4,14	3 4 4 3 5 5 5 5 3 4 4 5 4 5 5 5 4 4 5 5 3 4 3 3 4 4 4 3 3 4 4 4 4
7,97	3,97	La presentación estaba bien organizada y era fácil de seguir	4,00	4,07	3 4 5 4 5 4 5 4 3 5 5 4 4 5 4 4 4 4 4 4 5 4 4 4 4 4 4 3 3 3 4
		Los presentadores exponían el tema con claridad	4,20	4,21	4 4 4 3 5 5 5 5 3 5 5 5 4 4 4 4 4 4 4 5 4 4 4 4 4 4 4 4 3 4
		Los presentadores trataban de involucrar a la audiencia	3,80	3,46	3 5 5 4 5 4 3 1 3 4 5 1 1 4 3 1 1 3 5 3 4 5 5 5 5 4 1 4
	Grupo D	La presentación tenía contenidos valiosos, novedosos, interesantes	3,78	3,93	4 4 4 4 4 4 4 4 4 4 4 5 3 4 2 5 3 3 3 3 3 5 5 4 4 5 4 4 4 4 4 4 4
7,58	3,89	La presentación estaba bien organizada y era fácil de seguir	4,22	4,21	4 5 4 3 4 5 5 5 4 5 5 4 4 4 4 3 3 3 4 5 4 4 4 4 4 4 5 4 4 4 4 4
		Los presentadores exponían el tema con claridad	4,28	4,21	3 4 4 4 4 5 5 5 4 5 5 4 5 4 3 2 4 5 4 4 4 4 5 5 4 4 4 4 5 5 4 4 4
		Los presentadores trataban de involucrar a la audiencia	2,89	3,21	3 4 3 3 4 4 3 1 4 4 5 1 1 4 3 1 1 2 5 4 4 4 5 4 4 4 3 2 4
	Grupo E	La presentación tenía contenidos valiosos, novedosos, interesantes	3,69	3,68	4 3 4 3 4 3 4 5 4 4 3 4 2 5 3 4 3 3 4 4 4 4 3 3 4 4 4 4 4 4 4 4
6,81	3,49	La presentación estaba bien organizada y era fácil de seguir	3,75	3,68	3 3 4 4 4 4 4 5 4 5 4 4 3 3 4 3 3 3 3 5 4 4 3 3 3 4 4 3 4 3 4 3
		Los presentadores exponían el tema con claridad	3,69	3,68	3 4 4 3 4 3 5 5 3 4 5 4 4 4 3 2 2 3 5 3 4 3 4 4 3 4 3 4 4 4 4
		Los presentadores trataban de involucrar a la audiencia	2,50	2,93	4 5 3 4 4 3 3 1 1 4 5 1 1 4 2 1 1 1 5 3 4 3 3 3 3 4 2 4

# Conclusiones

- Trabajo en grupos, con presentación ante toda la clase
- Se han desarrollado preguntas para cada alumno
- Evalúan a otros grupos, a otros compañeros de su grupo y su propia contribución
- El proceso sirve para una evaluación más justa del trabajo individual
- El resultado fue ampliamente aceptado por los estudiantes.



# Application of teamwork methodologies in the context of Photovoltaic Solar Energy and the implementation of a peer evaluation system of individual contribution to group work (IPAC)

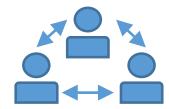
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**¡¡GRACIAS!!**



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Juan Bautista Arroyo-García, Antonio Joaquín Montañés-Espinosa

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## **IMPROVING TEAMWORK SKILLS IN SUBJECTS OF THERMAL ENGINEERING**

### **SUBJECTS INVOLVED:**

Thermodynamics and Fundamentals of Heat Transfer. Degree on Electric Engineering.

Thermal Engineering. Degree on Chemical Engineering.

Thermal Engineering. Degree on Industry Technology Engineering.

Energy Efficiency in Thermal Systems. Master on Renewable Energy and Energy Efficiency.

Hydrogen and Fuel Cells. Master on Renewable Energy and Energy Efficiency.

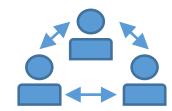
Energy Efficiency in Buildings. Master on Renewable Energy and Energy Efficiency.

### **LECTURERS INVOLVED:**

**Eva Llera, Sergio Usón, Ignacio Zabalza, Begoña Peña, Javier Uche, Mario Miana, Belén Zalba,  
Luis Miguel Romeo, Mariano Muñoz, Amaya Martínez.**

Thermal Systems and Engines Area. Department of Mechanical Engineering.

School of Engineering and Architecture. Universidad de Zaragoza.



### FRAMEWORK: Teaching and Innovation Projects:

- PIIDUZ\_18\_343: Improving Oral Communication and Teamwork in the Field of Energy Engineering.
- PIIDUZ\_19\_432: Communication and Collaboration. Improving Transversal Skills in Engineering Students.

### ACTIVITIES:

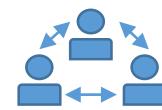
- **Workshops** on oral communication and teamwork techniques. Given by a psychologist.
- **Adaptation** and improvement of activities that include oral presentation and teamwork and improvement of evaluation methods of these activities.
- **Assessment** of the degree of success of the experience by surveys, observation cards and comparative analysis of marks.
- **Dissemination** of results.

### SOME RESULTS 18/19:

- **Issues to be improved** for next year: e.g. difficulty for enrolling students.
- **Good evaluation of workshops** by students: teamwork (left), oral communication (right):

	Amenity (1: no enjoyable, 5: very enjoyable)	Contents (1: no interesting, 5: very interesting)	Duration (1: too short, 5: too long)	Utility (1: no useful, 5: very useful)
1	0 %	0 %	0 %	0 %
2	0 %	0 %	0 %	0 %
3	9.1 %	27.3 %	100 %	9.1 %
4	36.4 %	54.5 %	0 %	54.5 %
5	54.5 %	18.2 %	0 %	36.4 %
<b>Average</b>	4.45	3.91	3	4.27

	Amenity (1: no enjoyable, 5: very enjoyable)	Contents (1: no interesting, 5: very interesting)	Duration (1: too short, 5: too long)	Utility (1: no useful, 5: very useful)
1	0 %	0 %	0 %	0 %
2	0 %	0 %	28.6 %	0 %
3	0 %	7.1 %	57.1 %	0 %
4	28.6 %	28.6 %	14.3 %	50 %
5	71.4 %	64.3 %	0 %	50 %
<b>Average</b>	4.71	4.57	2.86	4,5



## COURSE 19/20:

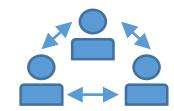
- Due to COVID19, **workshops could not be organized**.
- For the same reason, students had to develop **teamwork by using online tools**.
- **Surveys and observation cards** was used to know information about this change in several subjects: Thermal Engineering (Degree on Chemical Engineering and Degree on Industry Technology Engineering), Energy Efficiency in Buildings (Master on Renewable Energy and Energy Efficiency).

## SOME RESULTS: THERMAL ENGINEERING. DEGREE ON THEMICAL ENGINEERING.

- How the **situation affected teamwork?** From 1 (almost no affected) to 5 (strongly affected): 1 (36.5%), 2 (22.7%), 3 (13.6%), 4 (22.7%), 5 (4.5%); average: 2.36.
- **Main difficulties:** need more time for communication than in face to face, working in parallel with the same problem.
- **Online communication tools** used are summarized in the table (1: almost no used; 5 used very often).

	E-mail	Phone	WhatsApp or similar	Video call
1	28.6 %	57.1 %	0 %	13.6 %
2	23.8 %	0 %	0 %	4.6 %
3	14.3 %	4.8 %	13.6 %	4.6 %
4	19.0 %	14.3 %	18.2 %	13.6 %
5	14.3 %	23.8 %	68.2 %	63.6%
Average	2.67	2.48	4.55	4.09

- **Video call tools used:** mainly GoogleMeet, but also Skype and, sometimes, WhatsApp.
- Some students pointed out that working remotely was **initially a difficult situation** but finally they managed to solve it.
- Part of the evaluation was made by a **short online interview** by using a tool chosen by students: 59% used Skype, 30% GoogleMeet, 7% Zoom and 4% Hangout.



### GOOD PRACTICES:

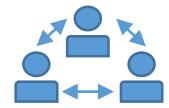
- Provide students **training** about teamwork: tools, methods for organization...
- A **short presentation** made by students or, at least, an **oral interview** reduces the risk of strongly unbalanced contributions.
- An **intermediate review** is also interesting.

### BACKGROUND OF INVOLVED LECTURERS:

- Most of **us** are **engineers** but also **chemists** and **physicists** are present.

### REQUIREMENTS FOR ADDITIONAL TRAINING FOR LECTURERS:

- Training on **information and communication technologies** would be useful for overcoming the requirements of online working. Fortunately, learning by doing was useful.
- Techniques for **improving evaluation** and for avoiding non-equal distribution of task woul be interesting.
- Although no relevant **problems among members** of groups have been detected, training about how to deal with these situations would also be useful.



## **Support for the Zaragoza (Spain) entrepreneurial ecosystem through Branding Design activity.**

Technology Transfer Office (University of Zaragoza), Semillero de Ideas (Zaragoza City Hall)  
and Degree in Engineering in Product Design and Development collaboration.

Anna Biedermann<sup>1</sup>, anna@unizar.es

Natalia Muñoz López<sup>1</sup>, nataliam@unizar.es

Camille Bertrand<sup>2</sup>, camille@unizar.es

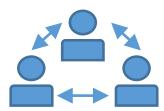
José Luis Santolaya Sáenza<sup>1</sup>, jlsanto@unizar.es

<sup>1</sup> Universidad de Zaragoza, Dept. of Design and Manufacturing Engineering

<sup>2</sup> OTRI Universidad de Zaragoza

## TEACHING PRACTICES IN TEAMWORK SOFT SKILLS

12<sup>th</sup> WORKSHOP ON GOOD TEACHING PRACTICES AND INNOVATION AT THE EINA



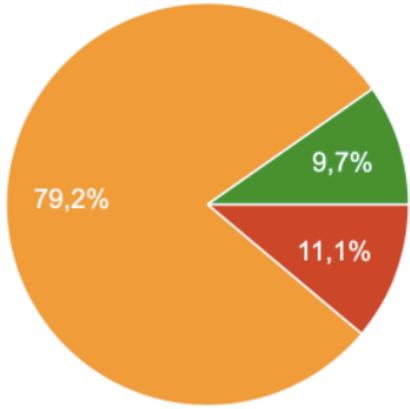
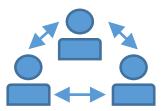
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Figure. 1. First meeting at Zaragoza Activa headquarters.



Figure. 2 . Alternative designs



- I don't see activities with real clients necessary
- I think they are necessary but in superiors courses
- Activities with real clients are necessary for students preparation for the professional future
- Activities with real clients make deliveries more difficult

**Figure.3** Students opinion about activities with real clients within academic works



**Figure. 4.** Chosen brand designs

- Competence of the subject
- Work team: entrepreneur +2 students
- Independent evaluation by entrepreneur and teachers (rubric)
- Satisfaction survey of both entrepreneurs and students
- Weekly mentoring



### Conclusions:

1.  
Lead by example:  
students should see us coordinating with other professionals or institutions.
  
2.  
Warn of possible problems that may occur during the collaboration and present possible solutions.
  
3.  
Draw up the collaboration bases with the obligations and precisely defined deadlines.
  
4.  
Make the results of the collaboration useful for someone- it motivates.

Recommended training - Mediation and conflict resolution.

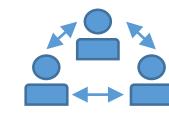
# *“Trabajos grupales basados en visitas a empresas en la asignatura Tecnología Energética del Master Universitario en Ingeniería Industrial”.*

Presentado por Inmaculada Arauzo, Dpto. Ingeniería Mecánica, Área Máquinas y Motores térmicos

- **Tips for successful in group teams.**
- **Motivation – How the work fits in the course.- Continuous reporting and feedback - Work distribution- Justice in the marking process**
- **Motivation**
  - “Intrinsic motivation” students must find the work interesting. Objective of the work: propose an energy supply scheme for an industry with a visit to the industry: Balay, GM (energy plant), La Zaragozana, Verallia).
  - “Extrinsic motivation”: 30% of the final mark of the course.
- **How the work fits in the course**
  - Practical sessions are used to progress in the work. 3 hours sessions: x% explanation- (100-x)% of team work.
- **Continuous report and feedback**
  - Review intermediate stages of the work (mid-work report)
  - Control tutoring

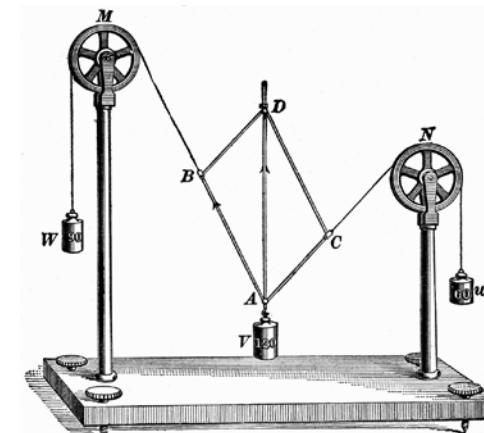
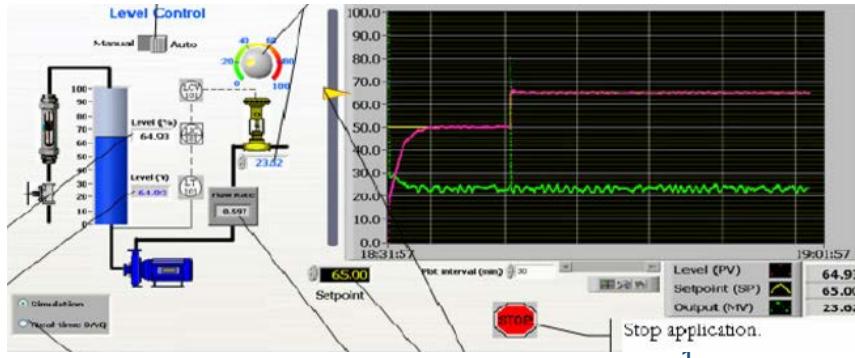
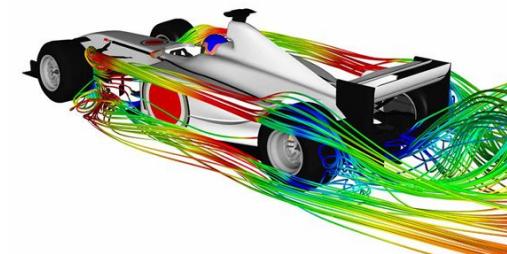
# *“Trabajos grupales basados en visitas a empresas en la asignatura Tecnología Energética del Master Universitario en Ingeniería Industrial”.*

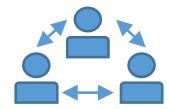
- **Motivation – How the work fits in the course – Continuous reporting and feedback - Work distribution - Justice in the marking process**
- **Work sharing**
  - Sometimes proposed works are difficult to share, because they cannot be done “in parallel”. If the goal is to explore several proposal for a problem is easier to share than if the goal is to develop a deeper approach.
- **Justice in the marking process**
  - A part of the mark is common for the team (70-80%), and another is individual (30-20%)
  - Proposals for individual marking: as a part of the work, they must explain how the work have been done. A bonus/penalty is applied if his/her part is worse or better than other parts.
  - Individual mark for oral presentation
  - “Observation” during group working sessions, participation in forums, tutoring sessions...



# Implementation of Problem Based Learning in four courses of Chemical Engineering BSc (Year 2)

F.J. Medel, E. Montijano, E. Natividad, L. Mariscal, M.A. Madre, E. Gil, J. Blasco





### MULTI-DISCIPLINARY

- Mechanics
- Materials
- Automatic Control
- Fluid Mechanics

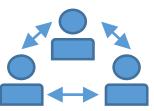
### EXAMPLES

- Design of a spray
- Design of an industrial bakery mixer
- Shelf life estimation of a cosmetic product
- 3D printing of a tensile specimen
- Design & 3D printing of a glider (race)

- ✓ Teamwork skill in course syllabus
- ✓ Students teamwork training

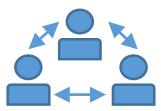
### NOTES

- “Supervising” methodology: lecturers only “guide”
- Teamwork grade: 50% process 50% final product
- IEEE student branch: great support for 3D printing (workshops, seminars, printing facilities).



(M) Minutes  
(R) Report  
(P) Presentation  
(TR) Team Rules  
(PR) Peer review  
(Mt) Meetings

	Aspectos a evaluar	Fuente	Peso
	(1) Critical thinking	M, Mt	10 %
	(2) Creativity	M, Mt	10 %
	(3) Language, spelling, clarity, order	M, Mt	5%
	(4) Oral defense	P	15%
	(5) Peer review	PR	<b>30%</b>
	(6) Application of PBL phases	M	5%
	(7) Quality of MOM (minutes of meeting)	M	5%
	(8) Planning	M	5%
	(9) Team rules	TR	5%
	(10) Bibliography	R	10%



### TEAMWORK BACKGROUND

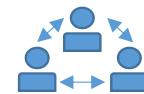
- MSc on Problem Based Learning (Aalborg University, Denmark)
- ICE's course on teamwork (Nov. 2020)
- We will meet with EINA TW experts (I. López, E. Manchado, I. Lidón, ...)

### RESULTS

- 25%: work hard and with enthusiasm. End up highly satisfied by their achievements
- 50%: work reasonably well but not passionately. Perform correctly
- 25%: not willing to work, lack of communication, empathy. Just pass the course.

### SOME IDEAS

- In classroom meetings, watch (from a distance) the team's atmosphere and interactions.
- Groups fail due to different expectations (just pass vs high grade)
- Students complain they spend a lot of hours
  - Tip: convince them that employers demand workers with good TW skills.  
E.g. Invite some professionals to talk about this.



**Design and coordinated planning of training activities associated with the learning outcome "teamwork" in the Degree in Mechanical Engineering**

Strategic innovation program in centers and **degrees** (PIET)

PIET\_19\_439

The project affects the entire degree, but mainly the last years

Mechanical  
Engineering

1º, 2º, 3º y 4º

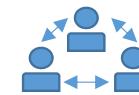
**Coordinator:** Amaya Martínez Gracia

Chairwoman of the Academic Commission of the Degree in Mechanical Engineering

**Participants** (members of the commission and professors of the degree):

Emilio Julián Royo Vázquez  
Paula María Canalís Martínez  
Fernando Vea Muniesa  
Iciar Alfaro Ruiz  
Sophie Gorgemans

Francisco Javier Brosed Dueso (ponente)  
Antonio Muñoz Porcar  
Manuela Pérez Pérez  
Bernardino Callejero Cornao  
Pedro Gaspar Ibáñez Carabantes.



## MOTIVATION:

### Prescription raised by the international EUR-ACE seal:

Increase the number of credits or training activities associated with the subjects that include the following learning outcomes and sub-outcomes:

- **Communication and teamwork**

Learning sub-outcome: Ability to function effectively in national and international contexts, individually and as a team, and cooperate with both engineers and people from other disciplines.

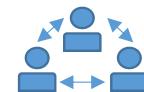
### Actions designed to comply with the prescription regarding teamwork:

Nº	Description	Responsible	Timeframe	Indicators
1	Increase in a coordinated way the number of <b>teamwork activities</b> in compulsory subjects in semesters 5, 6 and 7.	Degree coordinator Professors in charge of the courses	Courses 2019-20 & 2020-21	List of activities in course guides
2	Set up a map of the transversal competence "Teamwork", which includes the <b>distribution of the didactic objectives</b> between the subjects and their <b>evaluation methods</b> .	Degree coordinator	Courses 2020-21 & 2021-22	Map of the transversal competence

The main impact of the project is the passing of the revision of the EUR-ACE seal in 2021.

# TEACHING PRACTICES IN TEAMWORK SOFT SKILLS

## 12<sup>th</sup> WORKSHOP ON GOOD TEACHING PRACTICES AND INNOVATION AT THE EINA

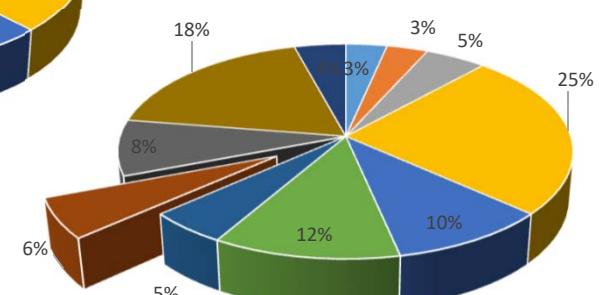
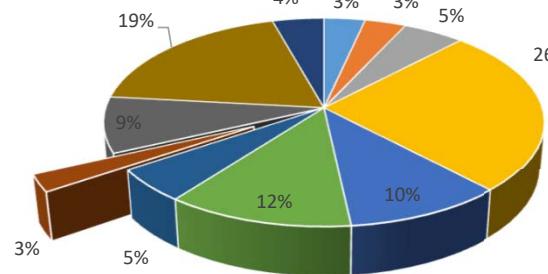


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	Competencias Genéricas – Generic Competences										
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
Matemáticas I (29700)	x			x	x			x	x	x	x
Física I (29701)			x	x	x	x			x	x	
Fund. de informática (29707)		x	x	x	x	x	x		x	x	x
Química (29704)			x	x	x	x	x	x	x	x	x
Expresión gráfica y diseño asistido por ordenador (29703)		x		x	x	x	x		x	x	x
Fund. de administración de empresas (29702)	x		x	x	x	x		x	x	x	x
Matemáticas II (29705)	x		x	x	x	x	x	x	x	x	x
Física II (29706)			x	x	x	x		x	x	x	x
Estadística (29708)	x	x	x	x	x	x	x	x	x	x	x
Matemáticas III (29710)	x	x	x	x	x	x	x	x	x	x	x
Termodinámica técnica y fund. de transmisión de calor (29713)		x	x	x	x	x	x	x	x	x	x
Mecánica de fluidos(29716)		x	x	x	x	x	x		x	x	x
Fund. de ingeniería de materiales (29712)			x	x	x	x			x	x	x
Fund. de electrotecnia (29715)			x	x	x	x					x
Fund. de electrónica (29721)		x	x	x	x	x					x
Sistemas automáticos (29726)			x	x	x	x					x
Mecánica (29711)			x	x	x	x			x	x	x
Resistencia de materiales (29717)			x	x	x	x			x	x	x
Tecnologías de fabricación II (29725)	x	x	x	x	x	x	x		x	x	x
Ingeniería del medio ambiente (29709)			x	x	x	x	x		x	x	x
Organización y dirección de empresas (29731)	x	x	x	x	x	x	x	x	x	x	x
Oficina de proyectos (29730)	x	x	x	x	x	x	x	x	x	x	x
Dibujo industrial (29714)			x	x	x	x	x	x	x	x	x
Tecnología de materiales (29718)			x	x	x	x	x	x	x	x	x
Máquinas y motores térmicos (29728)			x	x	x	x	x	x	x	x	x
Ingeniería térmica (29724)			x	x	x	x	x	x	x	x	x
Máquinas e instalaciones de fluidos (29729)			x	x	x	x	x	x	x	x	x
Criterios de diseño de máquinas (29723)			x	x	x	x	x	x	x	x	x
Mecánica de sólidos deformables (29722)			x	x	x	x	x	x	x	x	x
Teoría de estructuras y construcciones industriales (29727)	x	x	x	x	x	x	x	x	x	x	x
Tecnologías de fabricación I (29720)	x	x	x	x	x	x	x	x	x	x	x
Teoría de mecanismos y máquinas (29719)	x	x	x	x	x	x	x	x	x	x	x
TEG	x	x	x	x	x	x	x	x	x	x	x

### Map of the transversal competence

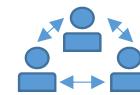
- C1   ■ C2   ■ C3   ■ C4   ■ C5   ■ C6
- C7   ■ C8   ■ C9   ■ C10   ■ C11



In collaboration with the teachers of the subjects and in a coordinated manner, teamwork is included in the following subjects of the 3<sup>rd</sup> & 4<sup>th</sup> courses:

- 29720 Manufacturing Technology I (S5)
- 29723 Machine Design Criteria (S5)
- 29730 Project Office (S7)
- 29731 Business Management and Organization (S7)





## Activities description in the course guide and their evaluation

29700 Mathematics I (S1)  
29705 Mathematics II (S2)  
29710 Mathematics III (S3)

29720 Manufacturing Technology I (S5)  
29723 Machine Design Criteria (S5)  
29730 Project Office (S7)  
29731 Business Management and Organization (S7)

### Teamwork:

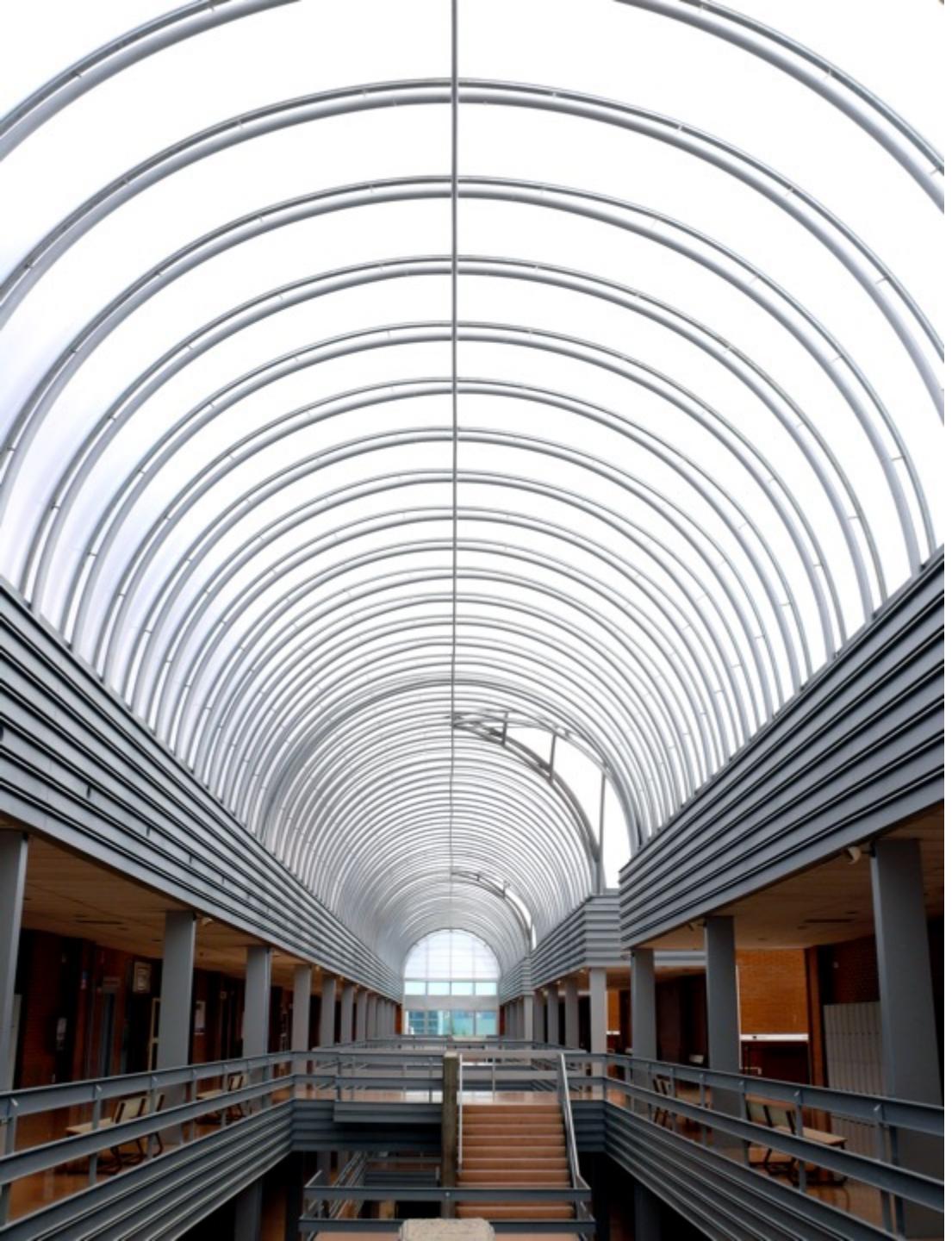
- Number of participants according to the total number of students in the subject
- Project milestones
- Project monitoring by seminars and interviews

### Evaluation:

- Participation in follow-up interviews
- Ability of each participant to answer the addressed questions
- Group grade and individual grade

### Main elements of teamwork:

1. Formation and rules of operation of the working group
2. Preparation and execution of a work plan
3. Establishment of operational work procedures
4. Organization of efficient meetings
5. Resolution of conflicts in the group
6. Proactivity and decision making
7. Evaluation of the operation of the group
8. Work in a multilingual environment



# XII SEMINARY INNOVATION AND GOOD TEACHING PRACTICES

STATE OF ART OF TEAMWORK SKILL AT THE UZ

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24 NOVEMBER 2020



Escuela de  
Ingeniería y Arquitectura  
**Universidad** Zaragoza

# PRESENTATION

The observatory of cross-disciplinary skills competences is a multidisciplinary group made up of teachers from different faculties:

Law | Education | Veterinary | Engineering and Architecture

More info: <http://ice.unizar.es/acerca-del-ice/programas-y-lineas-de-trabajo>

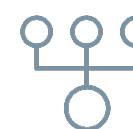
# OBJECTIVES



Analyse the current situation of training in cross disciplinary skills at Universidad de Zaragoza.



Elaborate a guide for the development and assessment of cross disciplinary skills at Universidad de Zaragoza. First step: teamwork.



Define a cross disciplinary skills map for all study programs at Universidad de Zaragoza.

# ACTIVITIES CARRIED OUT

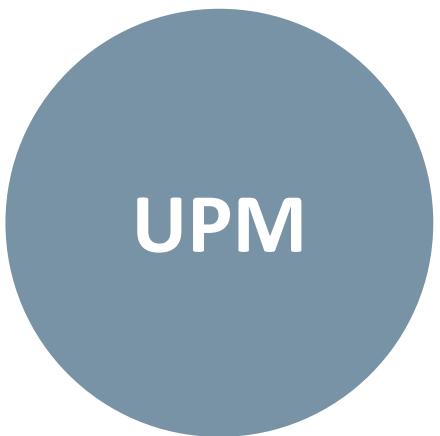
Adquisition of information and links of interest about teamwork: characteristics, implementation, methodologies, tools and assessment.

Review and discussion about teaching innovation projects relation to "teamwork" in the last years.

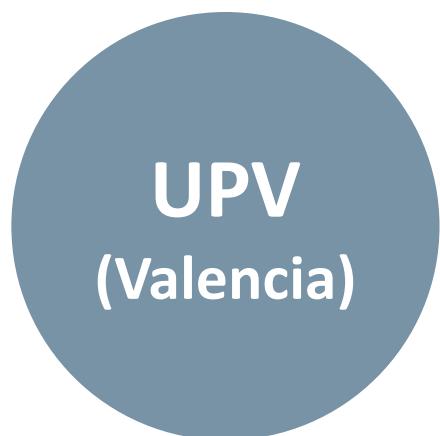
A first draft of dimensions and domain levels of Teamwork skills



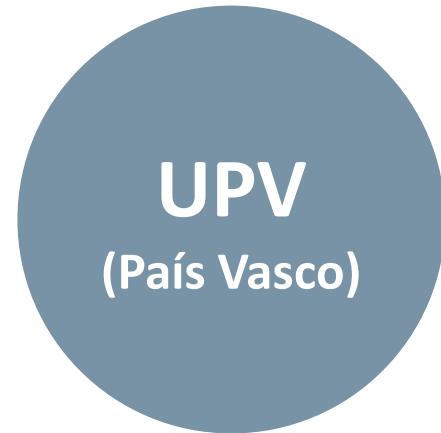
## KEY REFERENCES ...



**TRAINING AND EVALUATION  
OF TEAMWORK COMPETENCE**



**TRANSVERSAL  
COMPETENCES**



**CATALOGUE OF  
TRANSVERSAL  
COMPETENCES**

# OUR SITUATION

1

Between courses 16/17 and 18/19, 37 PIIDUZs directly related to teamwork were presented, 13 of them at EINA.

[Repositorio Buenas Practicas de Innovación Docente UZ](#)

2

**PIIDUZ\_16\_425 Planificación de las competencias transversales en los Grados de la Escuela de Ingeniería y Arquitectura**

3

**PIEC\_17\_114 Estructuración para la adquisición sistemática de las competencias transversales en los Grados de la Escuela de Ingeniería y Arquitectura**

# FIRST RESULTS

## FIRST PROPOSAL OF DIMENSIONS AND LEVELS OF TEAMWORK:

DIMENSION	SUBDIMENSION	LEVEL 1 (Guided)	LEVEL 2 (Oriented)	LEVEL 3 (Self-employed)
<b>Structural</b>	Integration in the team			
	Structure and composition of the team			
<b>Operation and management</b>	Organization and planification			
	Decision making			
<b>Interaction</b>	Attitude, behaviour			
	Group dynamics			
<b>Evaluación</b>	Proactivity and Leadership			
	Conflict management			
	Emotional management			
Self-assessment: Capacity for self-criticism / self-reflection				
Self-regulation and achievement of objectives				

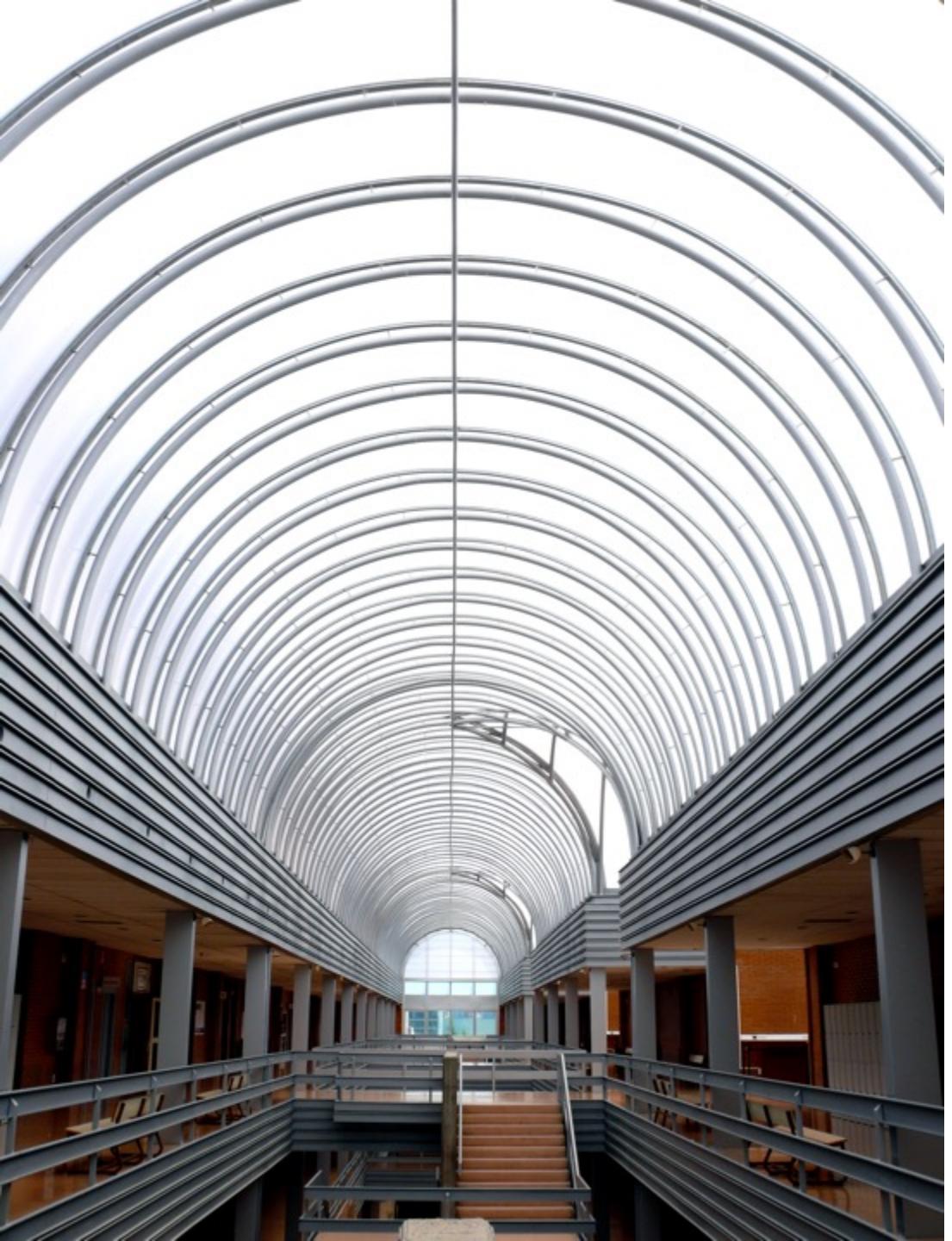
# NEXT STEPS

**Prepare a guide to develop teamwork skills:**

- Definition.
- Learning outcomes associated with the Teamwork.
- Levels associated with learning outcomes.
- Learning methodologies.
- Assessment systems and achievement indicators
- References
- Resources

**Continue addressing other cross disciplinary skills:**

**Communication**



# XII SEMINARY INNOVATION AND GOOD TEACHING PRACTICES

STATE OF ART OF COMPETITION TEAMWORK AT  
THE UZ

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