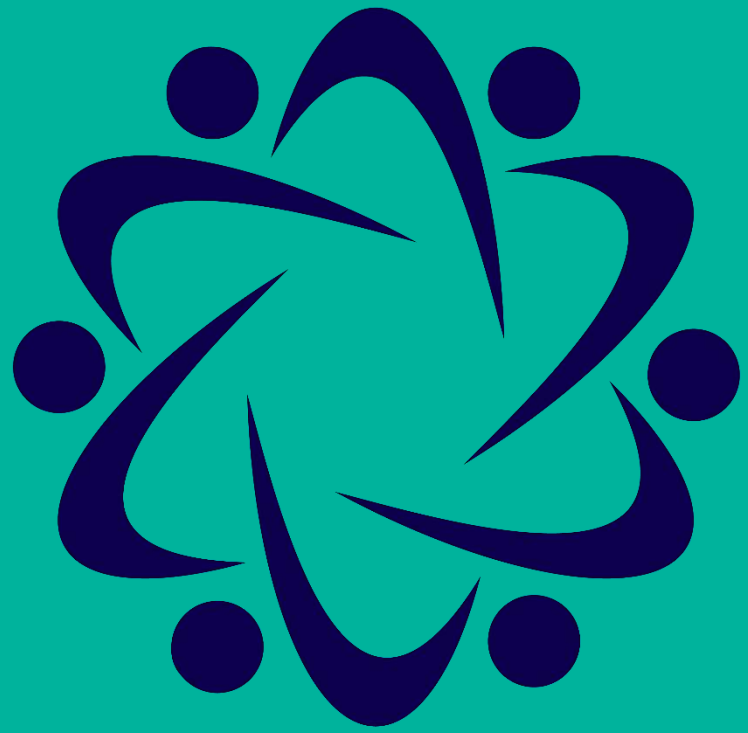
Cases of Experiential Learning projects: A successful model for HEI student-company cooperation



Dr. Silvia Satorres, University of Jaen (UJA), Spain

Mrs. Anneli Kakko, Jamk University of Applied Sciences (JAMK), Finland

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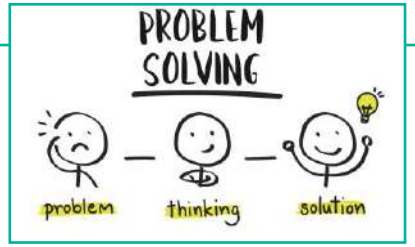
Content

Definition

Cases of Experiential Learning (CEL) projects

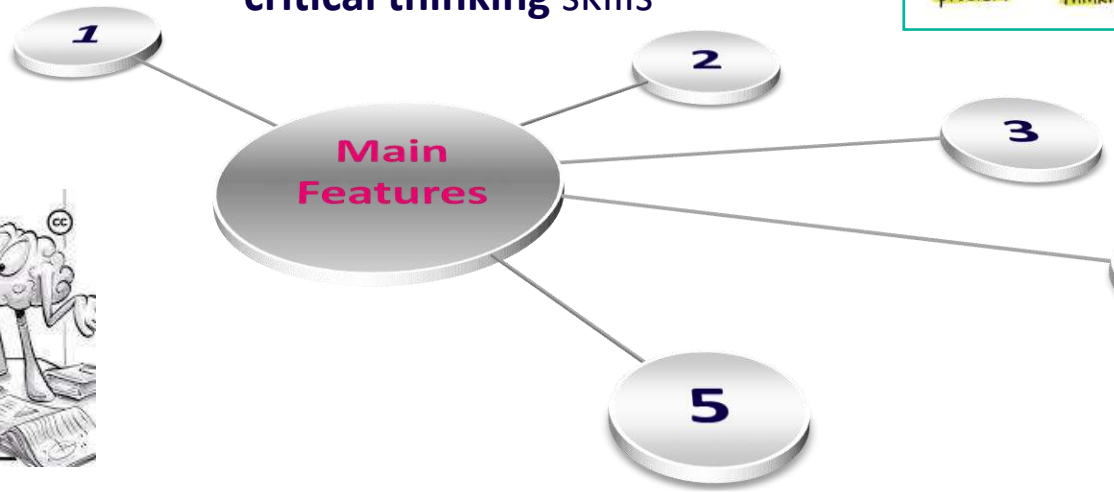
Formal definition

Project Based Learning (PBL) is a teaching method in which students gain knowledge and skills by working for an extended period of time (several weeks up to a semester) to investigate and respond to an authentic, engaging, and complex question, problem, or challenge



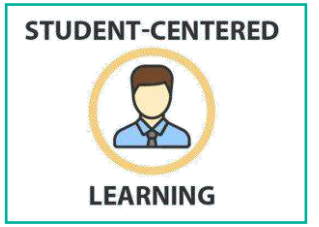
Active learning: students participate in hands-on activities and apply learning

Emphasis on **problem-solving** & **critical thinking** skills



Encourage **collaboration** & **team work**

Student-centered: allowing students to take an active role in their own learning



Assessment is based on the project and how well students applied the content

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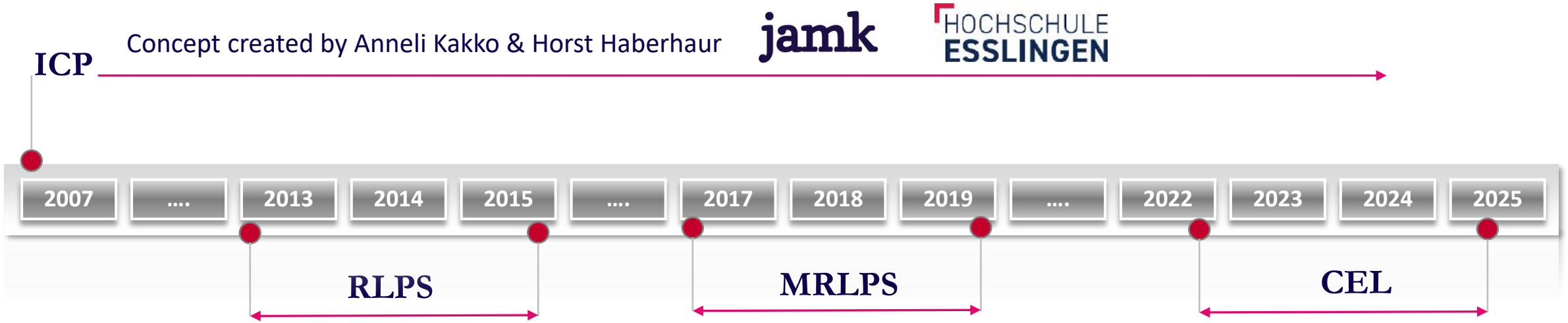
Background

Background

International Cooperation Project (ICP) has been the background for many international student project concepts



RePCI Reshaped Partnerships for Competitiveness and Innovation Potentials in Mechanical Engineering

HEIBus

NextGEng

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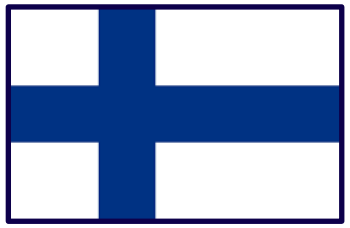
Background

International Cooperation Project (ICP)

- **Duration**: 1 semester & 5 ECTS credits
- **Who takes part?:** 8 JAMK students and 8 HE students and two supervisors from both universities
- Students form **two international teams** which compete each other
- **Real-life topic** and **tutors** for the project are always coming from **Finnish** or **German** companies
- **Two intensive weeks** one in both countries and HEIs
- HEI supervisors give the **grades** and company tutors choose the **winning team**



HOST COMPANIES: Moventas (2008), Valtra (2010 & 2012), Metso (2010), Elomatic (2011), HT Laser (2013), Pikval (ITAB Finland, 2016), Valmet (2022)

HOST COMPANIES: Festo (2009 & 2014), Festool (2011 & 2023), Kärcher (2012), Komet (2013), Heller (2015 & 2017), Werner Bayer (2019)

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Content

Upgrading the model

RePCI

REAL LIFE PROBLEM SOLVING

- Adapted from ICP

HEIBus

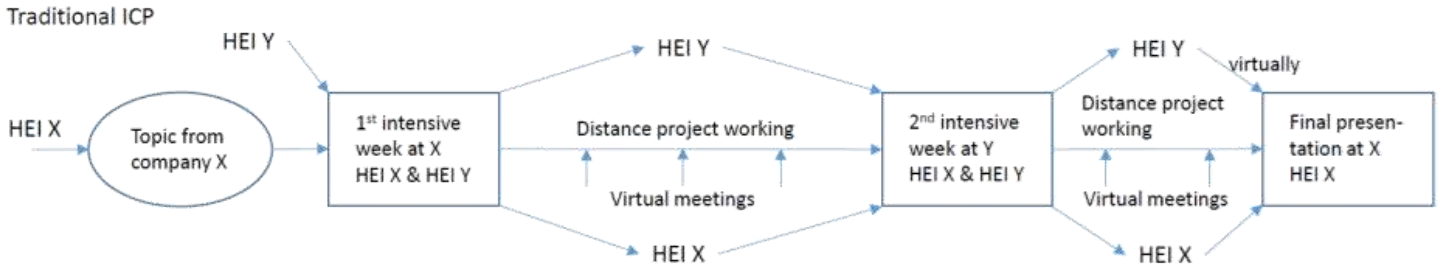
MULTIDISCIPLINARY REAL LIFE PROBLEM SOLVING (HEIBus)

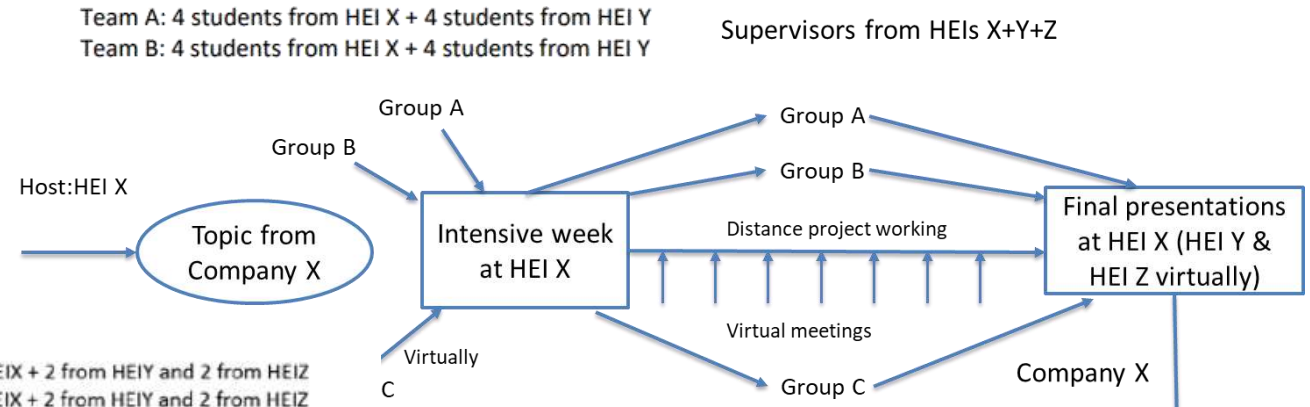
- Three groups of students
- Six students in each group
- Multidisciplinary team
- One group completely virtual

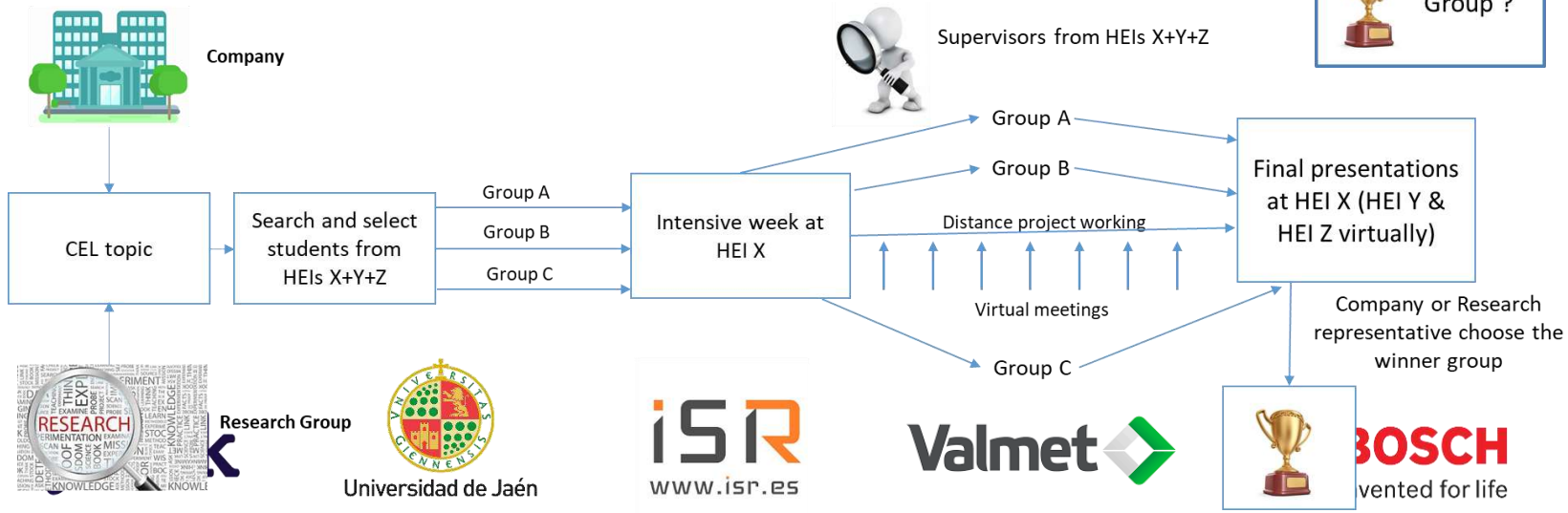
NextGEng

CASES OF EXPERIENTIAL LEARNING

- Topic from company or a research group
- No virtual group







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Content

First round of CEL

CEL projects in NextGEng

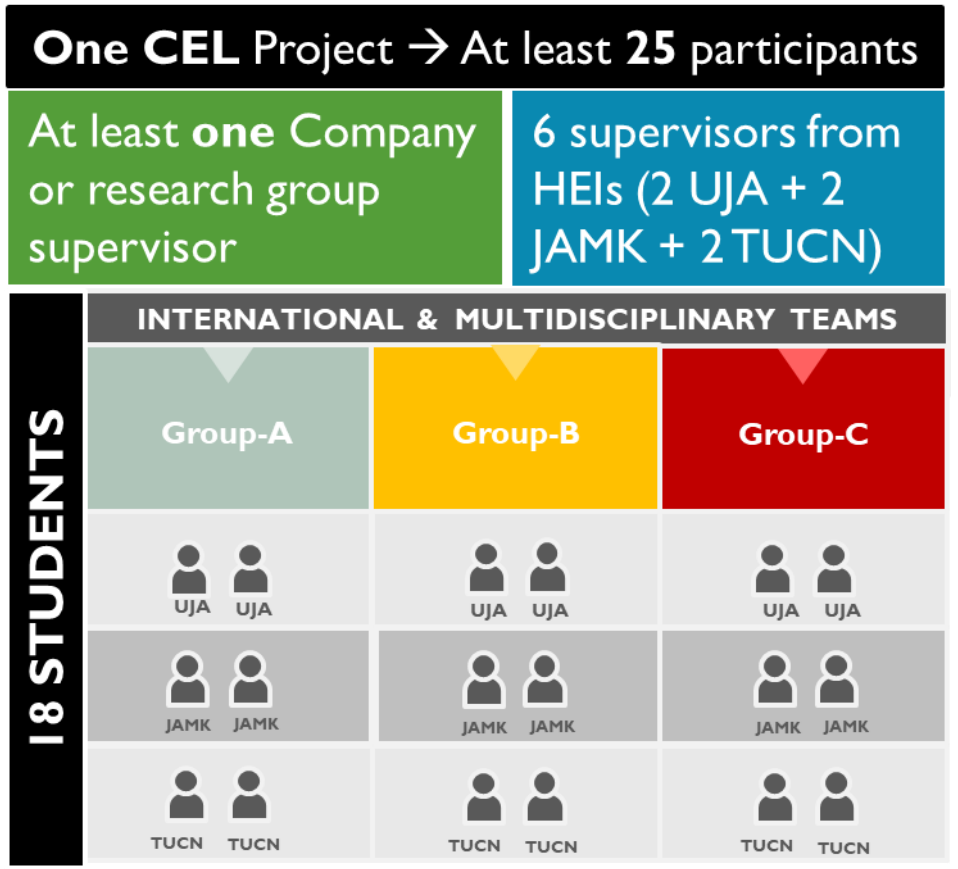
- Two rounds of CEL projects → 3 projects in each round
- At least 150 participants in total

ROUND	Company/research group representative	HEIs supervisors	Students
1	At least 3	18	54
2	At least 3	18	54

ROUND	Start Date	End Date
1	01/03/2023 (M6)	30/05/2024 (M20)
2	01/06/2024 (M21)	30/07/2025 (M34)

3 projects in 2023/2024, spring semester (ISR+TUCN research group + Valmet)

3 projects in 2024/2025, spring semester (UJA RG + Bosch + Valmet)



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First round of CEL

CEL1 → ISR

- **Title**: Design of an olive quality control system
- **Objective**: Design and develop a station (machine vision system) able to classify the olive quality based on multispectral and or hyperspectral images of olive fruits.
- **Student tasks**:
  - Project planning.
  - Acquisition station CAD design.
  - Development of computer vision algorithms for quality assessment

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First round of CEL

STUDENTS RESULTS

CEL1 → ISR

TRAINING GUIDE

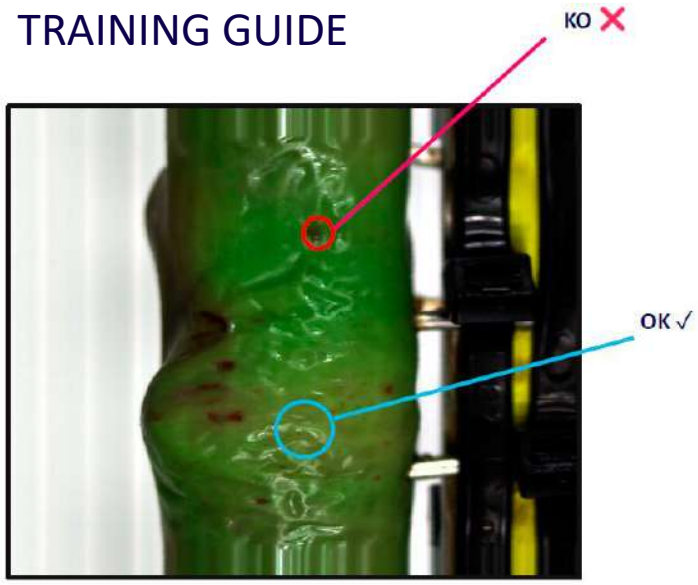


Figure 1: OK vs KO, bruised olive

FRUITS INSPECTION

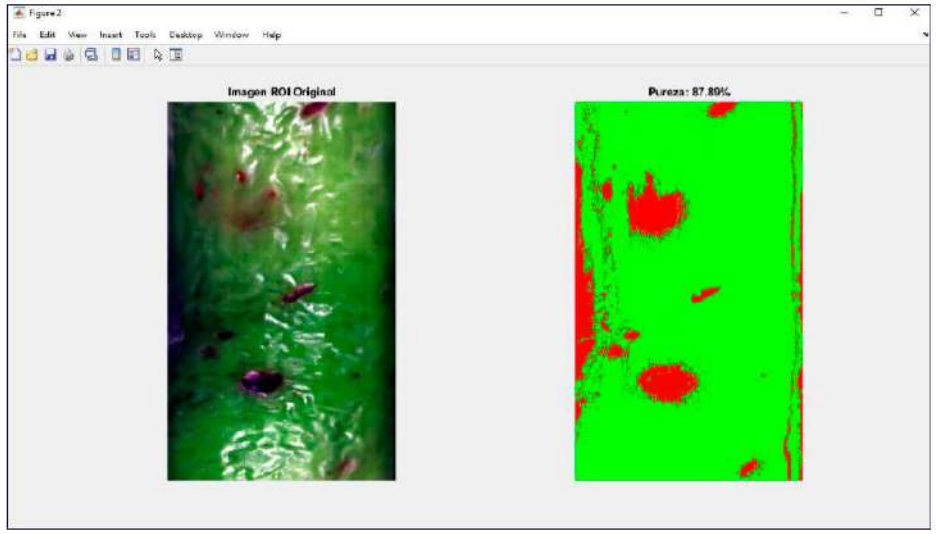
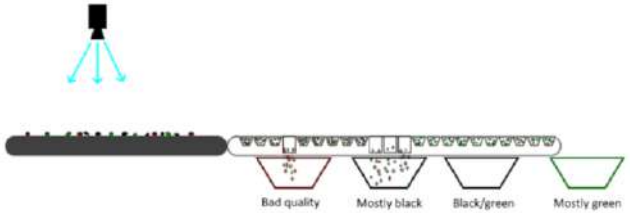
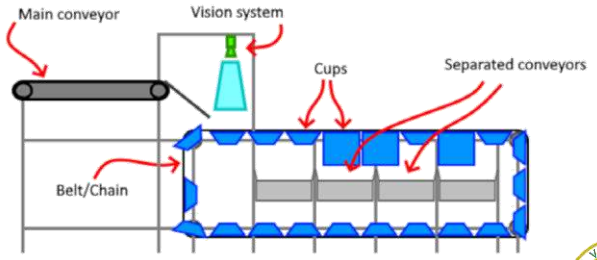


Figure 7: OK vs KO, Heat map

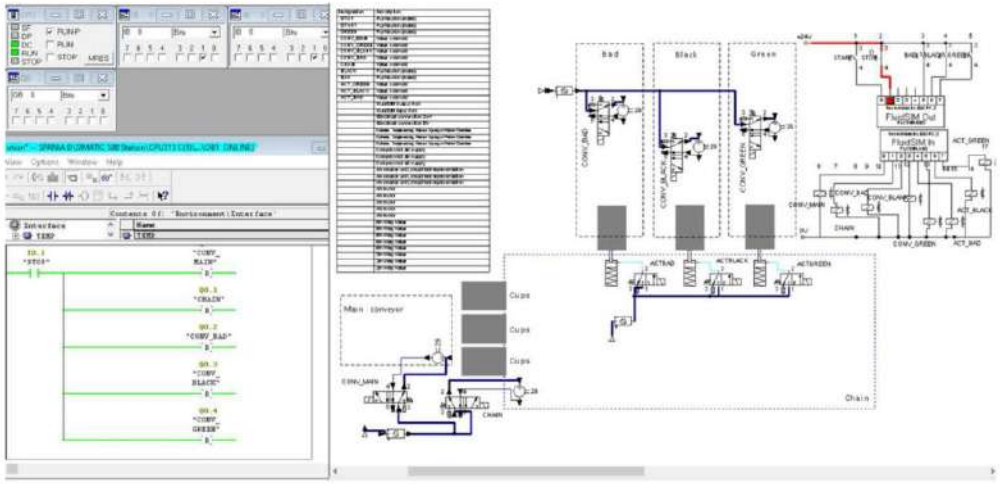
HOLDING DEVICES

MACHINE VISION SYSTEM DESIGN





PLC PROGRAMMING



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First round of CEL

CEL2 → TUCN

- **Title**: 3-axes GANTRY ROBOT (3GR)
- **Objective**: Design a 3-axes GANTRY ROBOT subject to the following requirements:
  - the movement along the X, Y, Z axes is carried out using electric motors mounted on the fixed base of the robot (they must not be mounted on moving parts)
  - the transmission of the movement for the axes (X, Y, Z) is done using toothed belts
  - the robot workspace is 300 x 400 x 200 mm3 (X, Y, Z)
  - on the Z axis a gripper is attached; the gripper must be able to manipulate workpieces with cylindrical geometry: 30 mm (diameter), 30 (height), 50 grams (mass); the gripper can be operated by any technology
- **Student tasks:**
  - Conceptual design of 3GR and gripper
  - Virtual prototyping and validation
  - Result analysis: benefits and drawbacks

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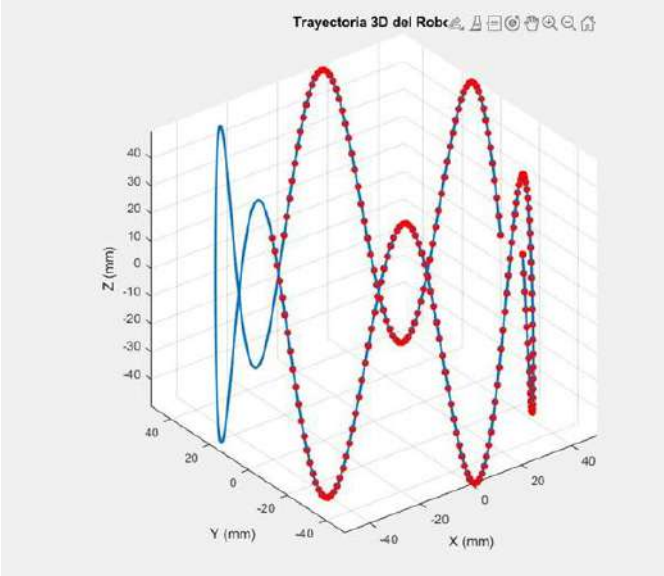
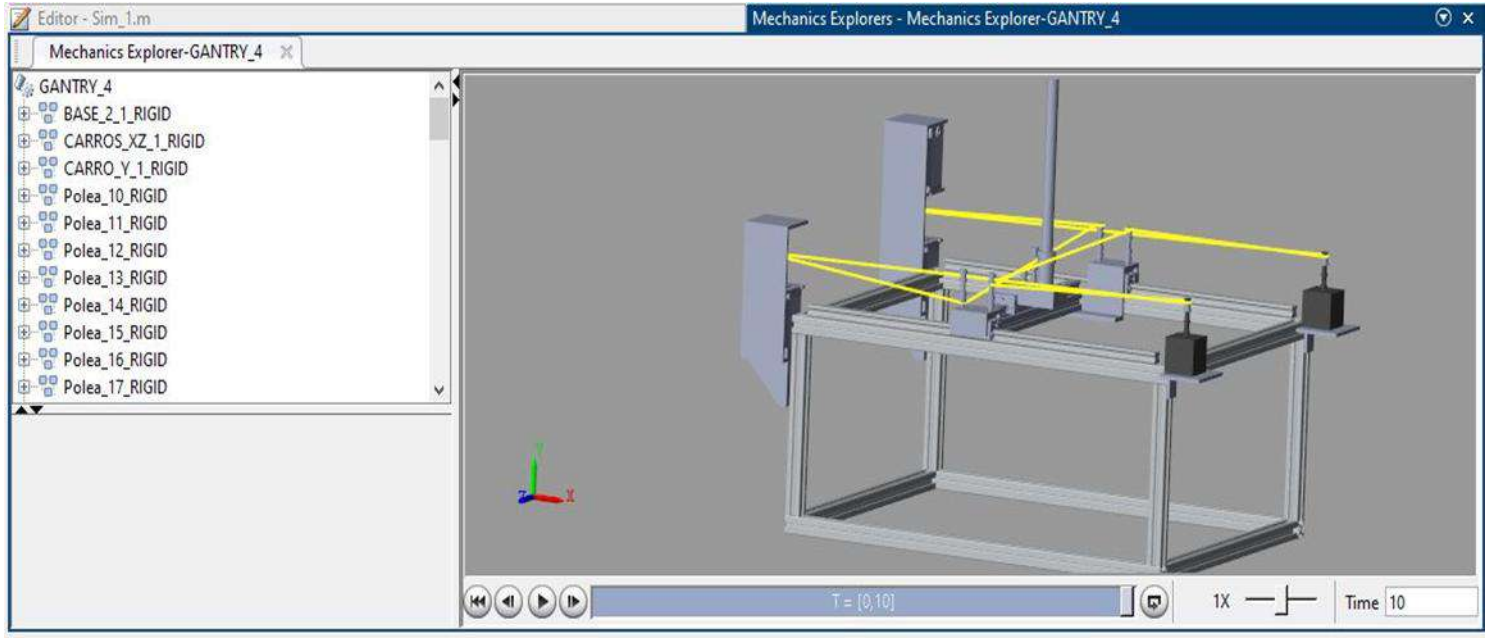
CEL2 → TUCN

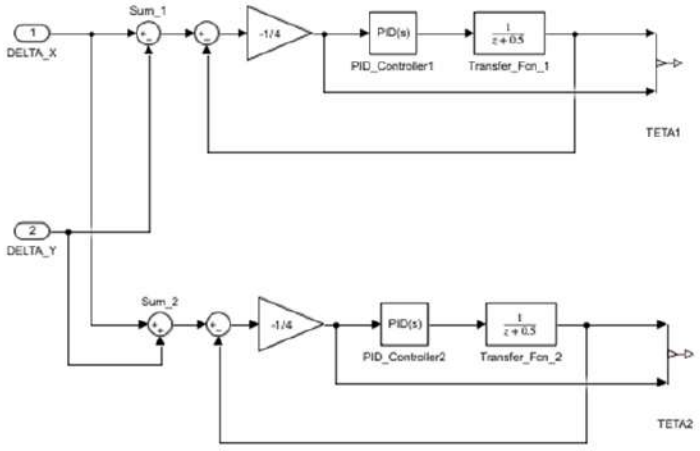
PATH GENERATOR

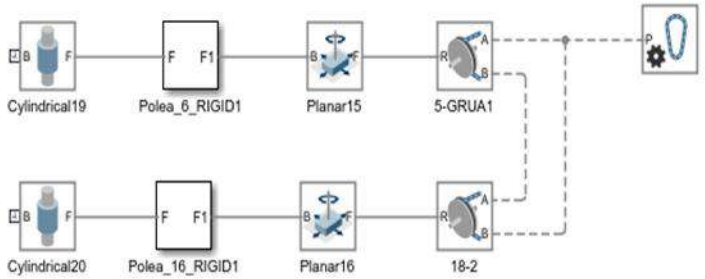


ROBOT SIMULATION



SIMULINK CONTROL LOOP



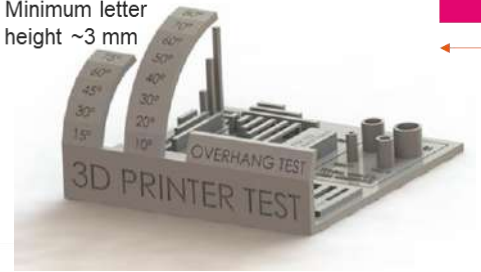


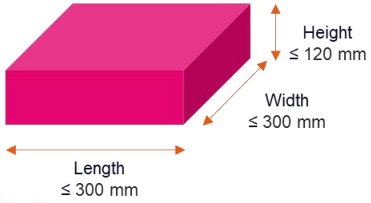
First round of CEL

CEL3 → VALMET

- **Title**: Design of a test object for a pressing-based manufacturing process
- **Objective**: Conceptualizing and designing a “test object” for a pressing-based manufacturing process. The knowledge from such tests can be used to adjust process parameters and mechanics for totally new concept of pressing wood-based materials
- **Student tasks**:
  - Project planning
  - Working with test object for a pressing-based manufacturing process
  - 3D models and/or concept-level technical drawings
  - Hand-drawn or digital illustrations (e.g. PowerPoint, Photoshop, Paint) or low- to medium-fidelity physical prototypes made from materials such as wood, plastic (3D-printing) or modelling clay

Valmet





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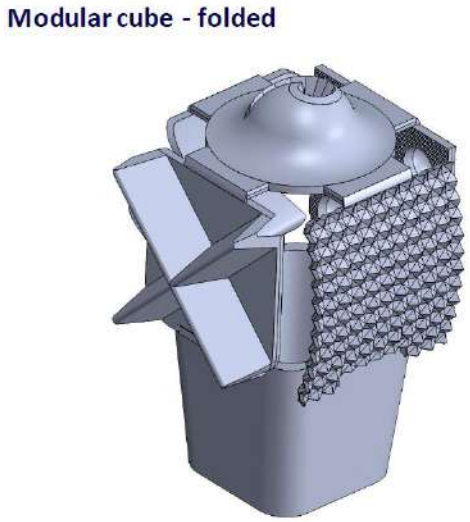
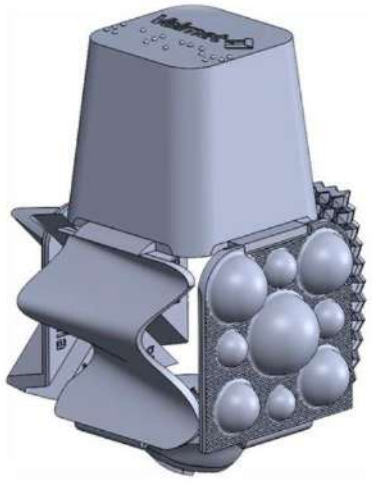
First round of CEL

CEL3 → VALMET

GROUP A





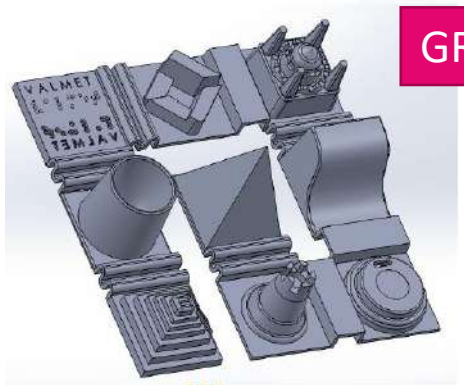
Requirements	
Rounded corner	✓
Sharp corner	✓
Steep wall	✓
Gently sloped wall	✓
Flat surface	✓
Single curvature	✓
Douple curvature	✓
Complex douple curvature	✓
Changing radius	✓
Small details	✓
Varying depths	✓
Intersections and points of discontinuity	✓

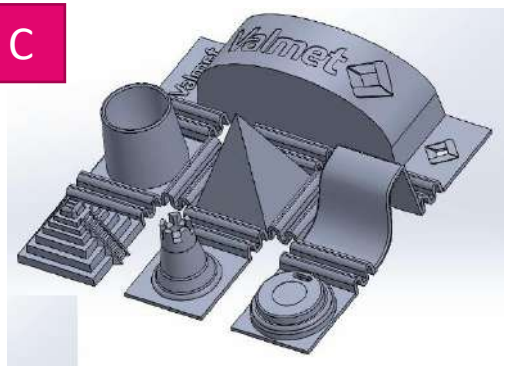
GROUP B

Manufacturability

- Thickness 2 mm almost everywhere.
- 5 degrees draft angle achieved. Some cylindrical shapes starts from zero draft.
- Total size under 180x180x60 mm

GROUP C





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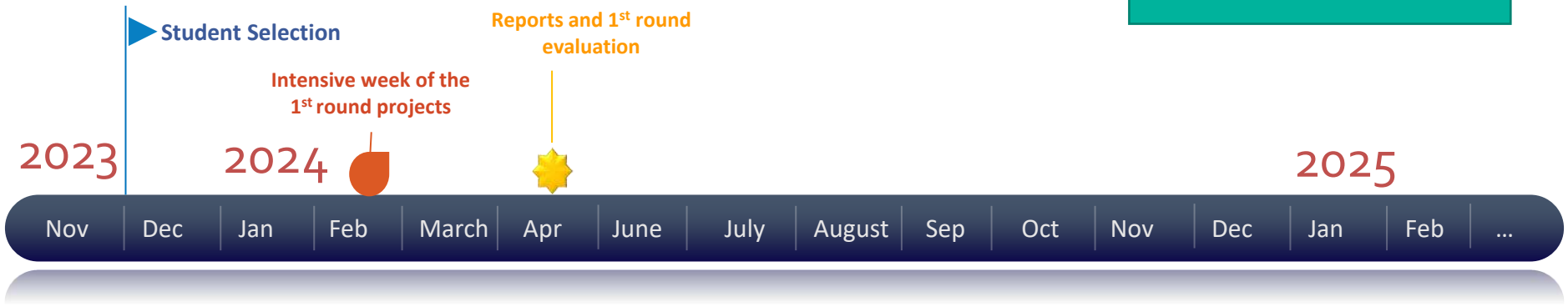
First round of CEL

SCHEDULE

Week 7 → Intensive week
Week 8
Week 9
Week 10
Week 11
Week 12
Week 13
Week 14
Week 15
Week 16
Week 17 → Final presentations



February

Wk	Su	Mo	Tu	We	Th	Fr	Sa
5					1	2	3
6	4	5	6	7	8	9	10
7	11	12	13	14	15	16	17
8	18	19	20	21	22	23	24
9	25	26	27	28	29		

March

Wk	Su	Mo	Tu	We	Th	Fr	Sa
9						1	2
10	3	4	5	6	7	8	9
11	10	11	12	13	14	15	16
12	17	18	19	20	21	22	23
13	24	25	26	27	28	29	30
14	31						

April

Wk	Su	Mo	Tu	We	Th	Fr	Sa
14		1	2	3	4	5	6
15	7	8	9	10	11	12	13
16	14	15	16	17	18	19	20
17	21	22	23	24	25	26	27
18	28	29	30				

- 18/04: CEL2-TUCN
- 25/04: CEL1-ISR
- 26/04: CEL3-VALMET

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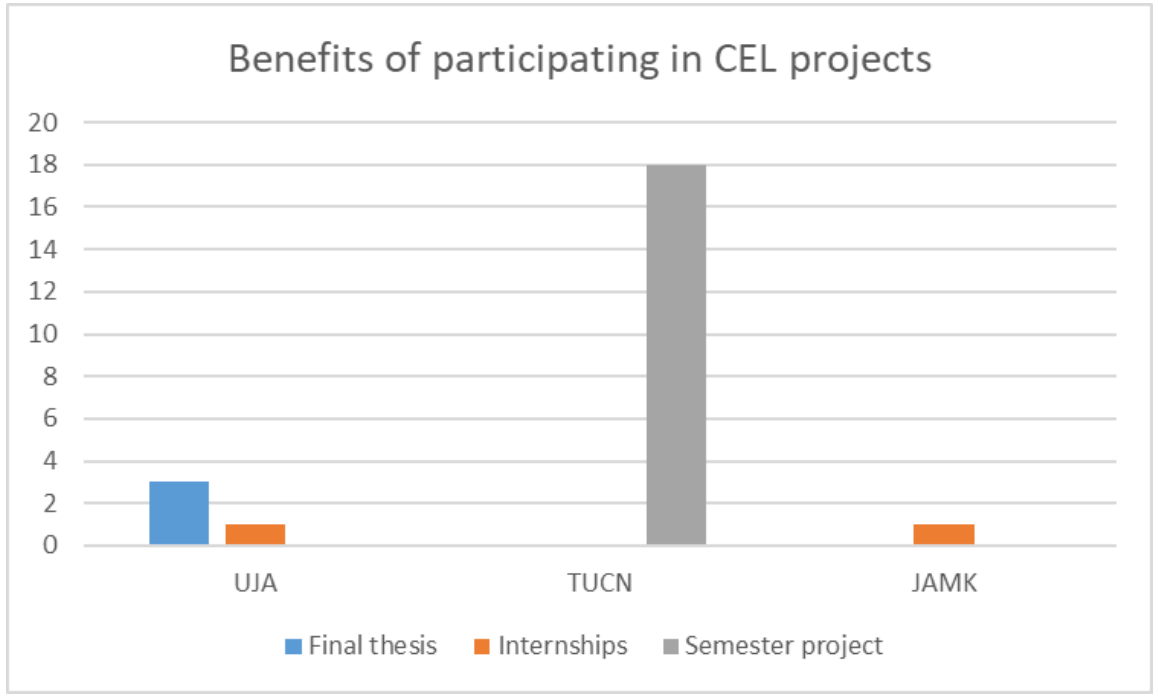
Results

Indicator code	Qualitative/Quantitative indicators	Result
Q1	- 50% of participant students gave positive feedback on CEL project activities, teachers involvement and company/research group experts interaction	- 78.2 % of the students were strong or rather agree about the HEI-supervisors support. - 86.6% were strong or rather agree about the company/research group experts support.
Q2	- 90% of the involved students pass the final CEL project assessment	- 100% of the involved students pass the final CEL project assessment
Q3	- 70 % of the students have improved their soft skills (work in teams, prepare and give presentations etc.)	- 90.9% of the supervisors were strong or rather agree that students have improved their soft skills (work in teams, prepare and give presentations etc.)
Q4	- 70 % of the students have improved their technical competences on the project topic	- 81.8% of the supervisors were strong agree that students have improved their technical competences on the project topic
Q5	- all (100%) participating students have work in international teams	- 100% worked international teams
Q6	- 1 report on CEL1-ISR project implementation	- 1 report: R4.7.a Report of CEL1-ISR implementation
Q7	- 1 virtual seminar	- 1 virtual seminar held on 19th of April 2024



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Results

- Great way to test your **creativity**
- Developing **soft skills** and interdisciplinary topics
- The atmosphere, challenge was greatly organized and had clear information. The **intensive weeks phase was also good**.
- The **meetings** were organized well and they were helpful
- International work. Interesting project. Professional supervisors.
- International experience, meeting great people, seeing other technical views or perspectives.
- **Approaching the real industry**, learning about its challenges and it functioning.
- To work **speaking only English**, since most probably it is what most of us will find when we look for a job

- **Longer intensive week**
- **More participants**
- I felt that one week after the last meeting **wasn't enough time to prepare the final report**.
- **Instructions for the final report** were very broad so I instructed my team to write it how I wanted it to be like! :D Moving forwards the final report should have better instructions.

STUDENT

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Results

- **Team working** for students from different universities, experience for students and teachers also, technical skills improvement of the students.
- Project topic; intensive week involvement from students and teachers; social activity
- Their **written reports have been improved** from the first draft to the final ones. Oral presentations have included a good combination of words, pictures, and graphics.
- Finally, the **collaborative work** is clearly evident that has represent a great perspective to get more experience and knowledge among the members of each group.
- **Mixed teams of two students each from the 3 participating countries**. Facing the difficulties at working in a collaborative groups.

- If **more days are allocated to intensive week**, I estimate an increase in the results produced by the students.
- I have detected in the **final reports** that students did not include any references (book, electronic manuals, software , etc..) and I consider these information is so important .
- About **oral presentations** , its contents should be structured and have the following parts: title participants, introduction, methods, results, discussion, conclusions and references. Not ever have been well-organized.

SUPERVISORS

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Content

Conclusions & Next Steps

BENEFITS OF DOING CEL PROJECTS

- Possibility of doing the bachelor thesis or semester projects in the project subject
- Internships
- Multidisciplinary cooperation
- International cooperation
- Solving a case of study from Industry
- Solving a case of study of a Research Group

TO IMPROVE

- Longer intensive weeks
- More time to prepare the final report
- Clear instructions to prepare the final report

Next steps for the second round

1. Topic selection 10/2024
   - Universidad de Jaén → Improving Products via Redesign for Additive Manufacturing
   - Valmet → Factory of the future in the paper industry
   - BOSCH Invented for life → Evaluation of the screws tightening and elongation in PCB mounting operations
2. Define the second round schedule (10/2024)
3. Participants selection (10/2024-12/2024)
4. Planning the trip for the intensive week (12/2024-02/2025)

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Conclusions & Next


JAMK, 2013


MISKOLC, 2017

KEY ASPECT: THE PARTNERS SELECTION


JAMK, 2018

2013 — 2014 — 2015 — .... — 2017 — 2018 — 2019 — .... — 2022 — 2023 — 2024 — 2025 — ....

RePCI

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NextGEng

Shall we continue?....


CLUJ, 2019


JAÉN, 2022


JAMK, 2023

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Thank you!

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