Co-funded by the European Union

Erasmus + KA2 project

Towards networking and collaborative teaching materials in field of industrial robotics (ROBINTECH)

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1. General information

In WP2 of the Robintech project, the task was to map the skills and competencies of the teachers participating in the project, related to the project's topic. Additionally, the task was to gather information about the partner institutions, such as the number of students, teaching methods, equipment (robot brands etc.) and applications, as well as the institutions' own needs regarding the teaching materials to be developed in the project.

There were two data collection methods. The Webropol tool, commonly used at OSAO, was used to assess the teachers' own skills and competencies. Organizational-specific information was collected collectively in Google Drive. The aspects to be mapped were defined together with the coordinator (VOCO).

The data collection was carried out in December 2024 and January 2025. The summary of the results was prepared by OSAO and delivered to the project partners in January. The summary was reviewed together in the first meeting of January 2025.

2. Teachers' skills and competencies

The teachers' skills and competencies were assessed with Webropol-tool and the following questions:

1. First name, Family name
2. Organization and main task / position in the institution
3. Experience in relation to this industry (year)
4. Current teaching areas: list the modules/topics that you currently teaching
5. Personal strengths and professional skills in relation to the Robintech theme
6. Rate your competencies as a teacher (scale 1 to 5, where 5 is the best)
    - to develop curricula and/or an appropriate implementation plan
    - to design, adapt and updating teaching materials and methodological materials for implementing learning outcomes
    - for planning and teaching process incl. designing and updating lesson plans and suitable methodologies
    - for creating and development of training materials and modules in digital platforms (Moodle)
    - use of digital platforms and technologies for teaching, incl. use of Moodle
    - to identify the learner's learning needs
    - to implement teaching process and support learners to achieve learning objectives
    - to provide feedback and assess learning and learner development
    - for updating professional competencies in the field and the profession, best practices and innovative technologies
    - language competencies: knowledge and skill for using English language for professional development
    - digital competencies: knowledge and skills to use digital tools and technologies for professional development
7. Name at least 1 specific skill or knowledge that you wish to elaborate within the project.
8. Name at least 1 specific skill or knowledge that you are ready to share to the other project partners.
9. Additional information / comments

Results can be found from the section 4.

3. Organization specific information

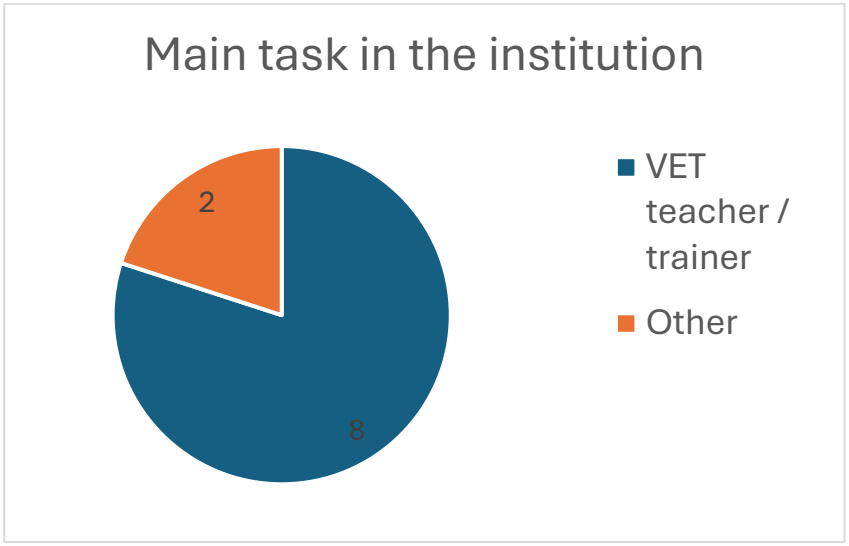
Organization specific information was assessed with the following questions:

1. Organization
2. Number of students in your organization who are studying in the field of Robintech related studies (yearly)
    - EQF level 3
    - EQF level 4
    - EQF level 5
    - Other, please specify
3. Taught topics and methods
    - Which Robintech related topics your organization is teaching at the moment?
    - Teaching methods used in your organization
4. HW, SW etc.
    - Robot brands used in your organization (list)
    - Other equipment and/or environments
    - Softwares and applications used in your organization (list)
5. Developing the materials
    - What would be the main theme or topic your institution would like to work on?

4. Results

Teachers' skills and competencies

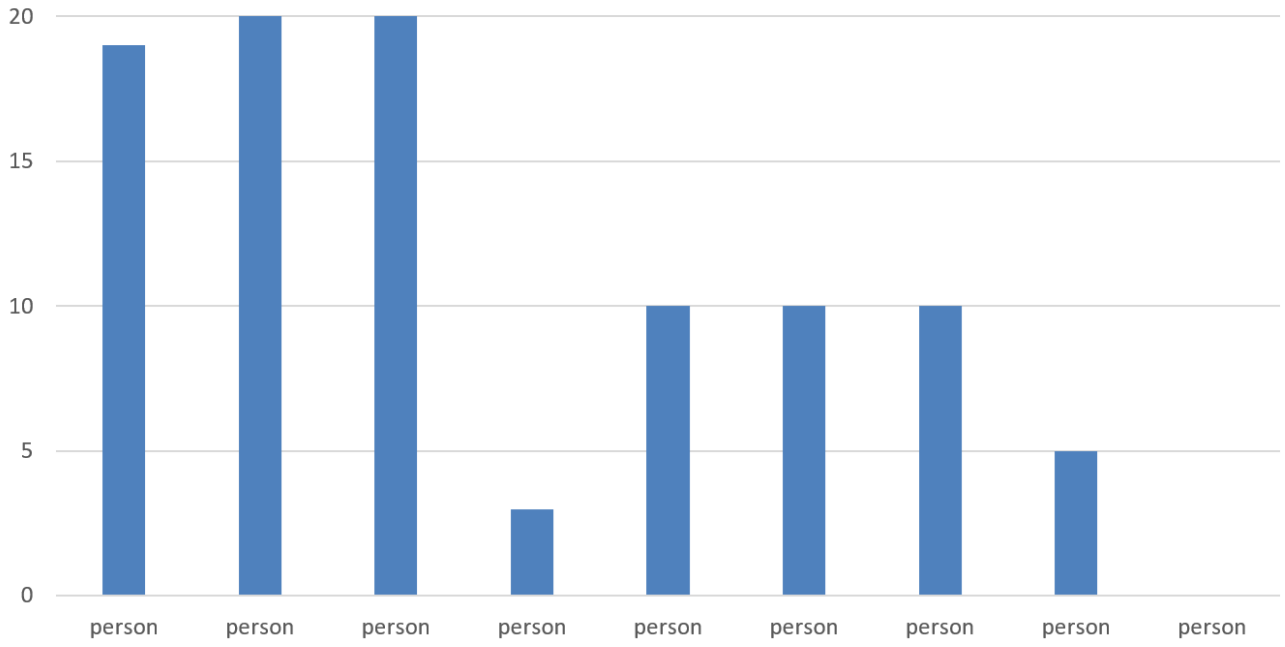
Personal information (name) will not be published. Eight respondents said they were VET teachers / trainers and one also informed to work as an teacher coordinator. One respondent said that he/she was working as an educational specialist.



Graph 1 Main task in the institution

Experience in related to this industry in years: three respondents had 19 or 20 years of experience, three had 10 years, one had five years and one had three years of experience.

Experience in years:



Graph 2 Experience in years in related to this industry.

Current teaching areas. Modules/topics that you are currently teaching. Summary of the answers:

Pneumatics and Electro Pneumatics Control: This includes the study of systems that use compressed air and electrical signals to control machinery and processes.

PLC Programming: This involves programming programmable logic controllers (PLCs) which are used to automate industrial processes.

Machine Vision Systems: These systems use cameras and image processing to guide machines and inspect products.

Robot Programming (ABB/Mitsubishi): This covers programming industrial robots from manufacturers like ABB and Mitsubishi.

CNC, CAD/CAM: CNC (Computer Numerical Control) involves the automated control of machining tools, while CAD/CAM (Computer-Aided Design and Manufacturing) involves the use of software to design and manufacture products.

Electric Panel Design: This involves designing electrical control panels that house electrical components.

Database Creation and Management: This includes creating and managing databases for storing and retrieving data.

Industrial Communications: This covers communication protocols and systems used in industrial settings.

Mechatronics Subjects: This includes relays, automation, sensors, actuators, electrical wiring, and PLC programming with TIA portal.

Electrical Control Panels Design, EPLAN, VFDs, Robots: This involves designing electrical control panels, using EPLAN software, working with variable frequency drives (VFDs), and programming robots.

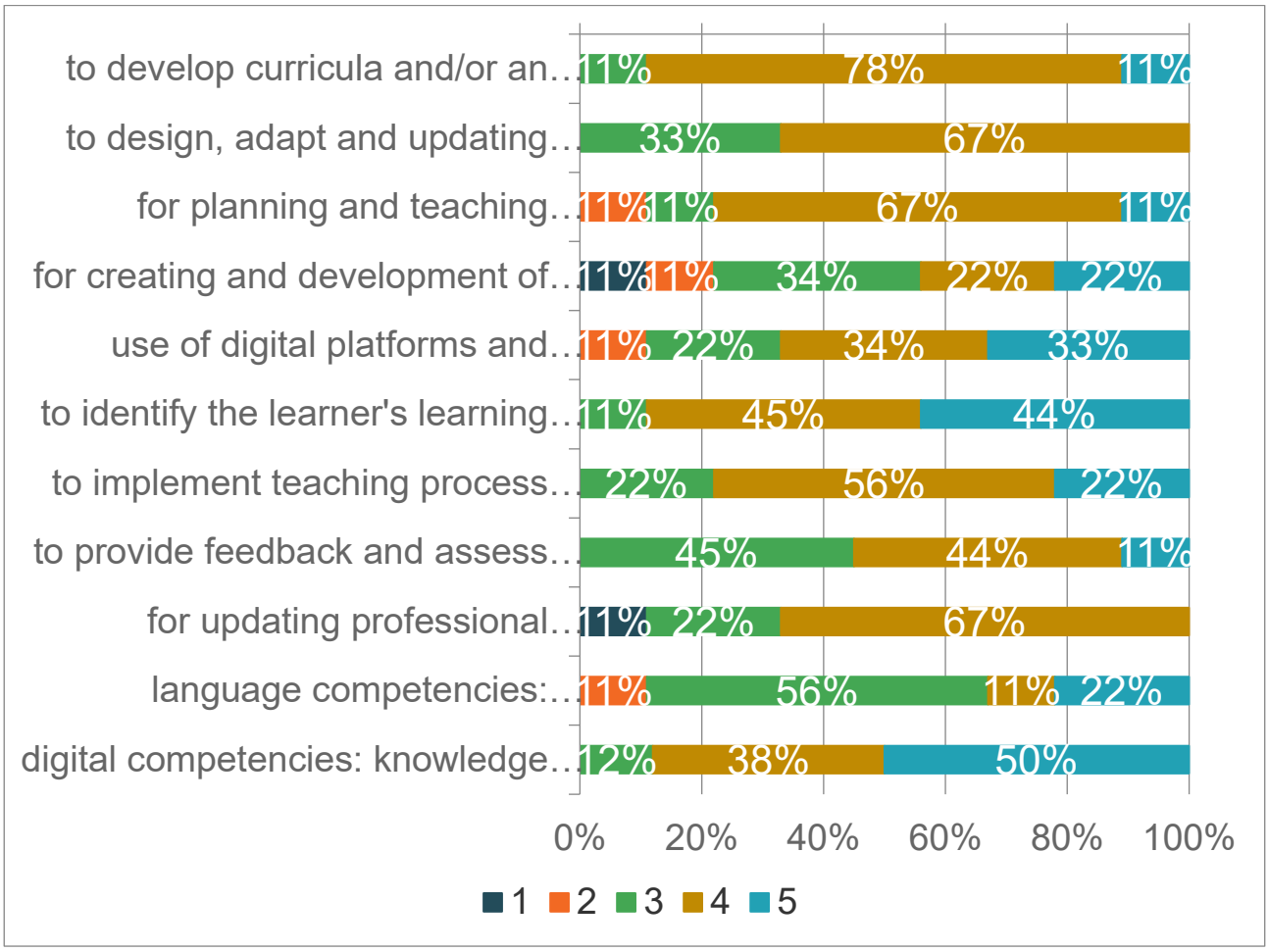
Automation, Electricity, Electronics, and Programming: This covers various aspects of automation, electrical systems, electronic components, and programming.

Digital Electronics, Microcontrollers, Electromechanical Circuits: This includes the study of digital electronics, microcontrollers, and electromechanical circuits.

Curricula development: This involves assisting teachers in developing and improving their curricula.

Personal strengths and skills as a summary: Some have a strong background in pneumatics control, electro pneumatics control, PLC programming, machine vision systems, and robot programming (ABB/Mitsubishi). Some have prior experience in metalworking and mechanical engineering and possess comprehensive knowledge of the entire automation process, from conceptual design to commissioning. Many of them excel in teaching the basics comprehensively, encouraging out-of-the-box solutions and supporting project-based learning. They are skilled in developing teaching materials using LMS (Moodle), delivering practical lessons. They can share knowledge on automation, VFD setup, motor control, electrical diagrams, and Universal Robot UR3 programming. Their strengths include curiosity, problem-solving, and integrating IoT and automation into projects. They are passionate about programming and emphasize collaboration in educational discussions.

Whan asked to rate person's competencies as a teacher (scale 1 to 5, where 5 is the best), the results were inline. Average in all statements were above 3,3, mainly above 4,0.



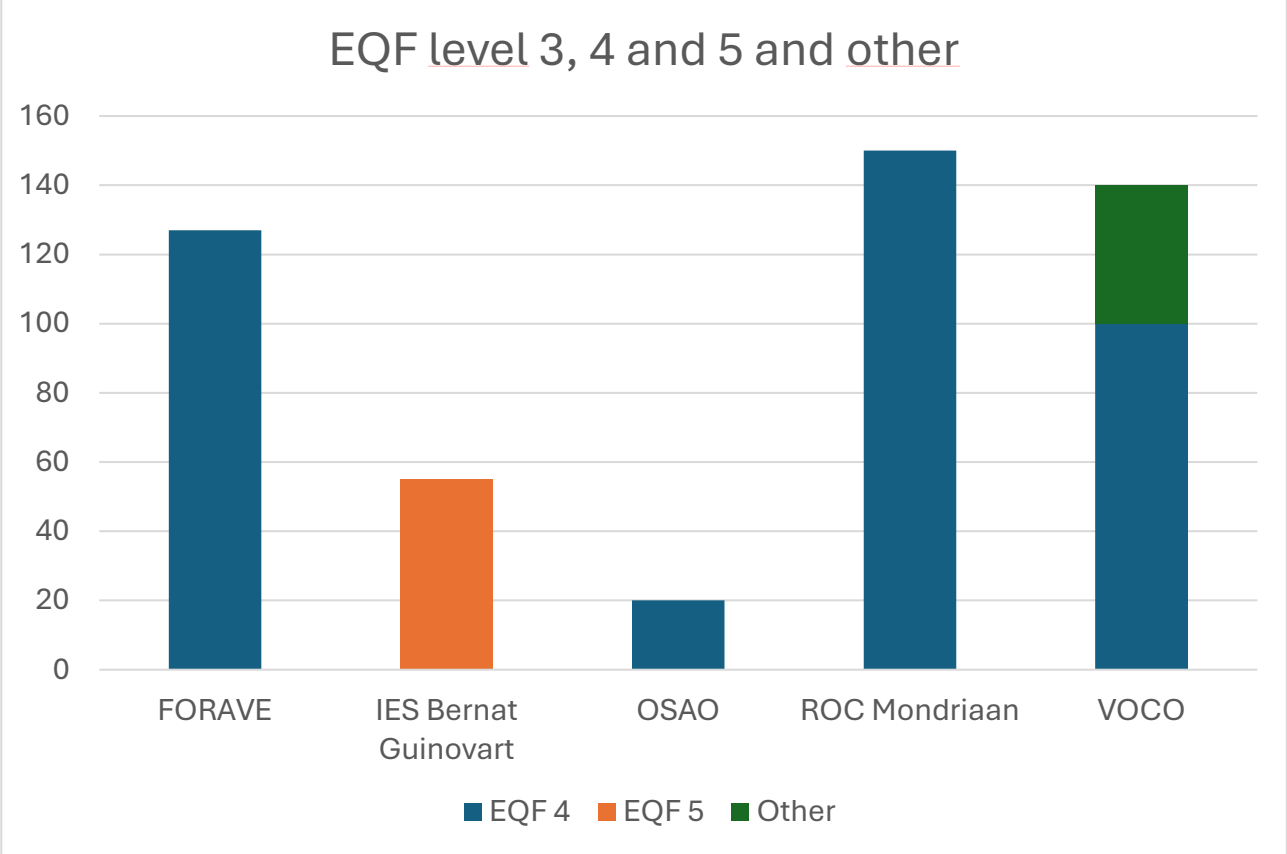
Graph 3 Rate your competencies as a teacher

When asked to name at least 1 specific skill or knowledge that you are ready to share to the other project partners, we found out that the project members are willing to share their knowledge in several areas. They have expertise in robot programming and machine vision systems, including basic methods for programming robots and PLC (Omron) programming. Share the knowledge concerning project-based learning approach. Additionally, they are ready to share their knowledge in system integration and optimization, particularly in connecting artificial vision technologies with existing infrastructure. Some of the persons also have expertise in artificial vision, focusing on how machines interpret visual information from the world.

Organizational information:

None of the institution have EQF level 3 students in the field of Robotics and automation. All the organizations have EQL level 4 students. IES Bernat Guinovart had also EQF level 5 students and VOCO had short course trainees from companies.

All together organizations had 297 students in the level of EQF 4, 55 EQF level 5 and 40 other students (from companies).



Graph 4 Number of students who are studying in the field of Robintech

Taught topics and methods: A variety of Robintech-related topics are taught in partner organizations. These include PLC programming, robot programming, electrical panels design and construction, IT programming, pneumatics and electropneumatics, sensors, vision sensors, and industrial communications. Additionally, some courses cover database creation and management (DDBB), microcontrollers programming, and machine vision systems integrated with robots and PLCs. The students gain a well-rounded understanding of both theoretical and practical aspects of industrial automation and control systems.

Methods used in partner organizations: a variety of teaching methods are used to ensure a comprehensive learning experience. These methods include time-based teaching, project-based learning, master classes, and individual or group activities. Additionally, classroom education, lab sessions, and competence-based approaches are used to enhance students' practical skills and theoretical knowledge.

List of robots used in partner organizations:

- Fanuc: Known for its industrial robots used in manufacturing and automation.
- Universal Robots: Specializes in collaborative robots (cobots) that work alongside humans.
- ABB: Offers a wide range of industrial robots for various applications.
- Kuka: Renowned for its industrial robots used in automation and manufacturing.
- Mitsubishi: Provides industrial robots for automation and manufacturing processes.
- Dobot: Known for its educational and industrial robotic arms.
- MiR: Specializes in mobile robots for industrial automation.

Listo of other equipment and/or environments used in partner organizations:

- PLCs: Siemens, Omron, Schneider, and Mitsubishi PLCs are used for automation and control systems.
- Machine Vision Systems: Cognex and SIck (Cognex) cameras are employed for machine vision applications.
- Festo Equipment: Festo CEC and Festo MPS systems are used for practical and laboratory lessons.
- Other Equipment: This includes SMC FAS, frequency converters, servo systems, 3D printing, Controllino, and FANUC CNC machines.

Softwares and applications used in partner organizations:

- TIA Portal for automation solutions.
- Factory IO for 3D simulation.
- EPLAN for electrical engineering design.
- Visor Sensor by Cognex and Sensopart for machine vision.
- Roboguide for FANUC robot simulation.
- Sysmac Studio, Machine Expert, and Automation Studio for automation systems.
- Kukasim and Robotstudio for KUKA and ABB robots.
- NodeRed, XAMPP, and Grafana for data integration and visualization.
- RT-Toolbox 2/3 and Sick Sopas for robot programming and sensor configuration.
- AutoMapps, Festo FST4, and Festo Codesys for automation and control.
- CODESYS for controller programming.
- Siemens Capital electra and EasyEda for electrical design and PCB layout.
- Festo Fluidsim for pneumatics and hydraulics simulation.
- Autodesk Inventor for 3D mechanical design.
- Arduino and Q Electrotech for electronics and electrical design.
- CAD/CAM software for design and manufacturing.
- RoboDK and SOPAS for robot programming and sensor configuration.

Organizations gave information about the topics they would like to work on, such Practical applications of Artificial Vision in Engineering and Industry, EPLAN, TIA portal and/or Sysmac Studio, Machine vision systems or Welding with a robot, PLC-communion and IoT, Integration of robots with CNC machines.

5. Summary

The Competence Audit Report for the Robintech project, dated March 4, 2025, provides a comprehensive overview of the skills and competencies of teachers participating in the project, as well as organizational-specific information from partner institutions.

The report outlines the task of mapping teachers' skills and competencies related to the project's topic and gathering information about partner institutions, including the number of students, teaching methods, equipment, and applications. Data collection was carried out using the Webropol tool and Google Drive in December 2024 and January 2025.

Teachers' Skills and Competencies

Teachers' skills and competencies were assessed through a series of questions, including their experience, current teaching areas, personal strengths, and professional skills. The results showed that teachers have a strong background in pneumatics control, electro pneumatics control, PLC programming, machine vision systems, and robot programming (ABB/Mitsubishi). They excel in teaching basics comprehensively, encouraging out-of-the-box solutions, and supporting project-based learning. They are skilled in developing teaching materials using LMS (Moodle) and delivering practical lessons.

Organizational Information

The report includes information about the number of students studying Robintech-related subjects at different EQF levels. It also lists the topics currently taught, such as PLC programming, robot programming, electrical panels design, IT programming, pneumatics and electropneumatics, sensors, vision sensors, and industrial communications. Various teaching methods are used, including time-based teaching, project-based learning, master classes, and individual or group activities.

Equipment and Software

The report lists the robot brands used in partner organizations, including Fanuc, Universal Robots, ABB, Kuka, Mitsubishi, Dobot, and MiR. Other equipment includes Siemens, Omron, Schneider, and Mitsubishi PLCs, Cognex and SIck (Cognex) cameras, Festo CEC and Festo MPS systems, and various other tools and systems. Software and applications used include TIA Portal, Factory IO, EPLAN, Visor Sensor by Cognex and Sensopart, Roboguide, Sysmac Studio, Machine Expert, Automation Studio, Kukasim, Robotstudio, NodeRed, XAMPP, Grafana, RT-Toolbox 2/3, Sick Sopas, AutoMapps, Festo FST4, Festo Codesys, CODESYS, Siemens Capital

electra, EasyEda, Festo Fluidsim, Autodesk Inventor, Arduino, Q Electrotech, CAD/CAM software, RoboDK, and SOPAS.

The report concludes with a summary of the main themes or topics that institutions would like to work on, such as practical applications of artificial vision in engineering and industry, EPLAN, TIA Portal, Sysmac Studio, machine vision systems, welding with robots, PLC-communication, IoT, and the integration of robots with CNC machines. These topics will be confirmed during spring 2025.

6. Closing words

As a result of the mapping exercise, project partners will have a better understanding of the skills that project members have, and the environments and resources in which organizations provide relevant teaching and guidance to students. It was a pleasure to see that there is a wide range of expertise and knowledge. It is to our advantage that there are similarities but also differences between the organizations, for example in terms of equipment. We can learn from each other and share know-how.

After mapping the competences and resources of the organizations, we can move on to the next phase of the project. Organizations will soon confirm the topics for the training materials to be developed.

Thank you to the individuals and organizations who participated in the surveys! We will continue our good cooperation and development activities throughout the project.

Competence audit report prepared by OSAO Niina Nissinen, Heikki Litendahl

Annex

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Robintech project

Highlights

Information from Webropol survey

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the European Union

Huge amount of experience in relation to this industry:

- 3-5 years (2 VET teachers)
- 10 years (3 VET teachers)
- 19-20 years (3 VET teachers)

Personal strenghts and skills:

- Passion for programming
- Solving complex problems and creating efficient and innovative solutions
- Combining programming skills and automation
- Integrating emerging technologies into projects
- Knowledge how to prepare technical practices, how to setup VFD, control motors, program Universal Robot and design electrical diagrams
- Developing teaching materials
- Delivering practical and laboratory lessons using Festo Didactic learning systems
- Experience in PLC programming using Codesys
- Experience in project-based teaching
- Knowledge of automation process
- Metalworking and mechanical engineering

Teaching ares:

- Automation
- Electronics
- Digital electronics
- Microcontrollers
- Electromechanical circuits
- Electricity
- Programming
- Electrical control panel design
- EPLAN
- VFDs
- Robots
- PLC programming
- Electro pneumatics control
- Mechatronics subjects
- Electric panel design
- Database creation and management
- Industrial communications
- Machine vision systems
- Robot programming (ABB/Mitsubishi)

Competencies as a teacher Knowledge and skills...	Average value
to develope curricula	4,0
to design, adapt and update teaching materials etc.	3,7
for planning and teaching process incl. designing and updating lesson plans and suitable methodologies	3,8
to create and develope training materials in digital platform	3,3
use of digital platforms and technologies for teaching	3,9
to identify the learner's learning needs	4,3
to implement teaching process and support learners to achieve learning objectives	4,0
to provide feedback and assess learning and learner development	3,7
for updating professional competencies in the field and the profession, best practices and innovative technologies	3,4
language compentencies: knowledge and skill for using English language for professional development	3,4
digital competencies: knowledge and skills to use digital tools and technologies for professional development	4,4

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Robintech project

Highlights
Information from Google Drive

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Number of students (yearly):

- EQF level 4 → **297**
- EFQ level 5 → **55** (Spain)
- Other → **40** short course trainees (from companies)

Teaching methods:

- Time based
- Project based
- Competence based
- Master classes
- Individual / group activities
- Classroom education
- Labs

Topics teached in organizations:

- PLC programming (5)
- robots programming (5)
- Pneumatics and electropneumatics (5)
- Electrical panels design and construction (4)
- Sensors (4)
- Vision sensors (4)
- Industrial communications (4)
- IT programming (3)
- DDBB (2)
- Controls (1)
- Machine vision system with Robot/PLC (1)

Robot brands:

- Fanuc
- Universal Robots
- ABB
- Kuka
- Mitsubishi
- Dobot
- MiR

Other equipment:

- Siemens PLCs
- Cognex Cameras
- Omron
- Schneider PLCs
- Mitsubishi
- Festo
- Festo CEC
- Festo MPS
- Codesys
- Sick (cognex) machine vision systems
- 3D printing
- SMC FAS
- Frequency converters
- Servo systems
- Controllino
- Fanuc CNC

SWs and applications:

- TIA Portal
- Factory IO
- EPLAN
- Visor Sensor by Cognex
- Visor Sensor by Sensopart
- Roboguide
- Sysmac Studio
- Machine expert
- Kukasim
- RobotStudio
- NodeRed
- XAMPP
- Grafana
- RT-Toolbox 2/3
- Sick Sopas
- AutoMapps
- Automation Studio
- Festo FST4
- Festo Codesys
- Siemens Capital Electra
- EasyEda
- Festo Fluidsim
- Autodesk Inventor
- Arduino
- Q Electrotech
- CAD/CAM sws
- RoboDK
- SOPAS

New learning/teaching materials will be developed.
Selected topics:

- **FORAVE** Practical Applications of Artificial Vision in Engineering and Industry
- **IES B.G.** EPLAN, TIA Portal, Sysmac Studio
- **OSAO** Machine vision systems
- **ROC M.** PLC communication, IoT
- **VOCO** Integration of robots with CNC machines

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