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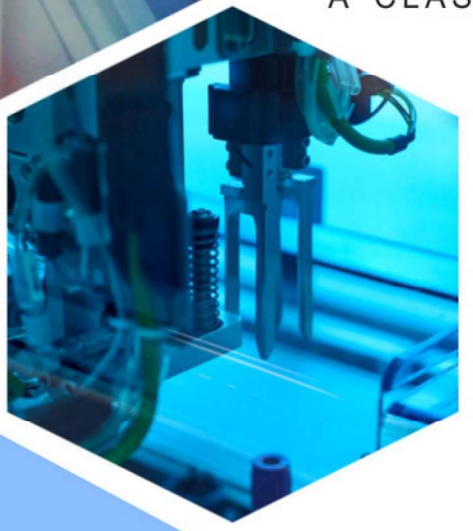

BEING A PART OF IT

METHODOLOGICAL GUIDE

TO TURN THE CLASSROOM INTO PART OF A COMPANY: FROM A CLASSROOM TO A RESEARCH LABORATORY

critical
TECHVETLAB
thinking

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This guide is a result of the project:

"TECHVETLAB: A SOLUTION FOR POSTCOVID-19 LABORAL MARKET THROUGH A TECHNICAL TRAINING OF VET STUDENTS WITH OBSTACLES."

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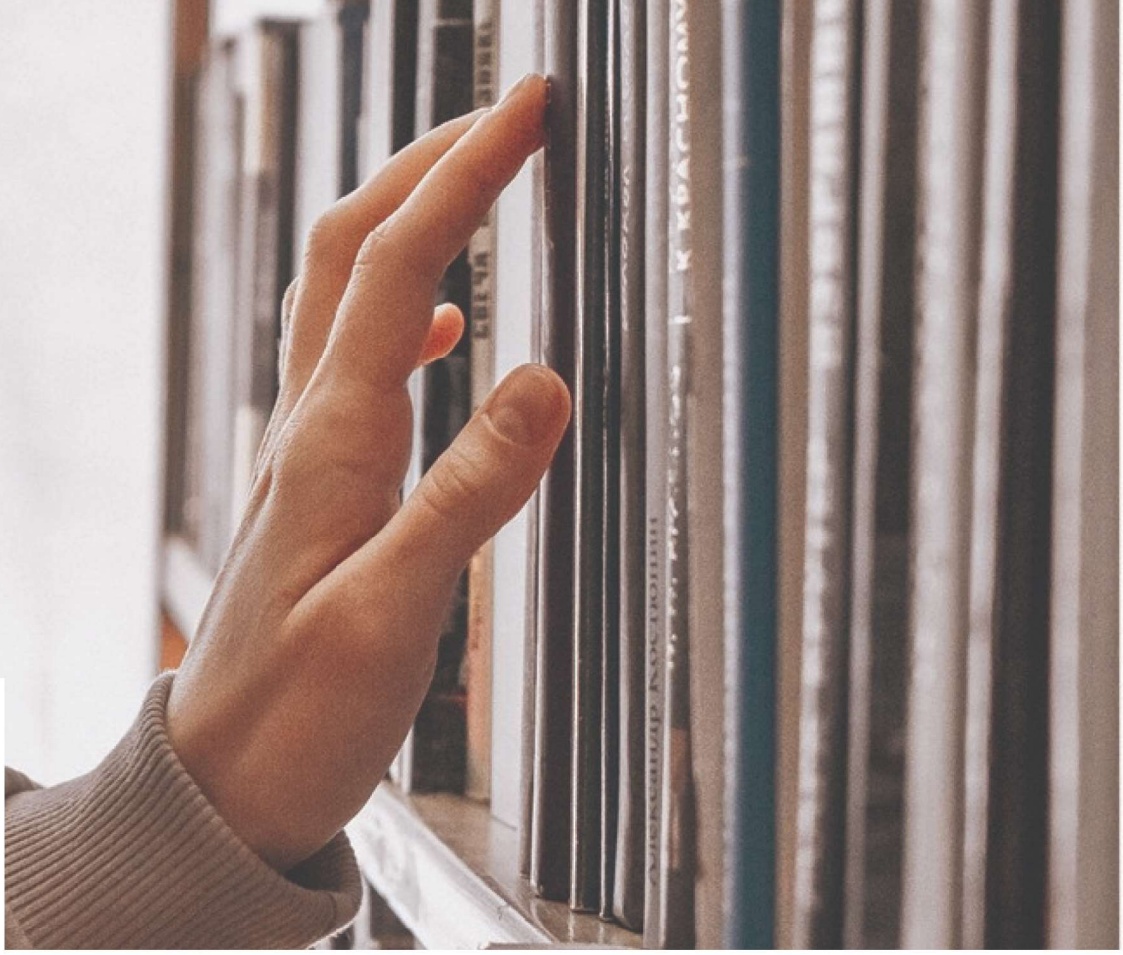
CONTENTS



01

INTRODUCTION

This guide is the result of the Erasmus Plus Programme project "TECHVETLAB: A SOLUTION FOR POSTCOVID-19 LABORAL MARKET THROUGH A TECHNICAL TRAINING OF VET STUDENTS WITH OBSTACLES". It is a project that has aimed to promote vocational training, VET, directly linked to the technology sector. To this end, we have developed an innovative teaching method where the classroom becomes a virtual department of the technology company, developing important parts of the company's research projects and training students with obstacles in the processes and transversal skills that favor their hiring.

This project seeks to respond to the needs raised by European and international institutions to generate new VET graduates capable not only of adapting to the reality of the post-COVID-19 labour market, but also of being fundamental agents in the post-COVID-19 European reconstruction, focusing especially on the students who will have the most difficulties in achieving it. those with economic, social, and cultural barriers from segregated backgrounds.

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After the pandemic, it has been very complicated and in some cases impossible for VET students, especially those with obstacles, to carry out mobilities or access the training in workplaces required in vocational training in Spain. For this reason, it is essential to generate new learning processes that make it possible to alleviate this lack of training in the work environment, which allows VET students to learn in demanding environments and to be co-participants in cutting-edge research projects.

To this end, the TECHVETLAB project has generated a very innovative methodology that allows the classroom as a whole to be introduced into the work dynamics of technology companies: THE BEING PART OF IT (BPI) METHODOLOGY.

The BPI methodology is a working method devised by experts linked to the project entities that represents an evolution of Project-Based Learning. Through this method, the school and the technology company reach collaboration agreements that allow a classroom led by a teacher to participate in a technological research project as if it were a department of the company. This system implements in the classroom the use of task management and distribution software used by technology companies in order to define tasks, schedule them and integrate them into the work times of the rest of the company's departments.

This working method is specified in this guide, the "METHODOLOGICAL GUIDE TO TURN THE CLASSROOM INTO PART OF A COMPANY: FROM A CLASSROOM TO A RESEARCH LABORATORY" where we explain step by step recommendations to implement a global adaptation of classroom planning, the implementation of virtual networking routines with the company and the use of digital tools that equate the classroom with the company.

02

OBJECTIVES

COVID-19 has had a strong impact on the global economy and employment, creating a weaker European society that will have to implement new and significant initiatives to alleviate the social, economic, educational and health consequences generated as a result of the pandemic.

Vocational Training can be the answer, but it needs to be adapted to the post-COVID-19 reality, becoming more attractive and focused on the lines required to alleviate the economic consequences of the pandemic and offer better alternatives to its students

We place the emphasis on focusing their training on the technology sector, promoting the learning of transversal skills, favouring digitalisation, active training and, above all, betting on the research capacity of vocational training.

These are the objectives of the Erasmus Plus project "TECHVETLAB: A SOLUTION FOR POSTCOVID-19 LABORAL MARKET THROUGH A TECHNICAL TRAINING OF VET STUDENTS WITH OBSTACLES".

A project created by a strategic network made up of European Vocational Training educational centres and technology-based companies that are implementing an innovative method of education in the Intermediate Level Vocational Training that promotes cutting-edge research work in vocational training, facilitates the employability in the technology sector of students with fewer opportunities and helps leading companies to develop the projects that we are interested in. to rebuild the EU after the pandemic.

To this end, we have created the innovative Being a Part of It (BPI) methodology, which allows the classroom as a whole to be introduced into the work dynamics of technology companies. This methodology is embodied in one of the main results of the Project: the "Methodological Guide Being a Part of It to turn the classroom into part of a company: from a classroom to a research laboratory" (Techvetlab, 2021).

This guide, aimed at technicians from technology companies and Vocational Training teachers, includes all the necessary guidelines for a VET classroom to become a virtual department of a technology company, participating in technological research projects for two months. Thus, this guide offers a global adaptation of classroom planning, the implementation of virtual networking routines with the company and the use of digital tools that equip the classroom with the company, allowing students as a whole to develop critical parts within cutting-edge innovation projects.

03

METHODOLOGY *BEING A PART OF IT*

The BPI methodology is a working method devised by experts linked to the entities of the Erasmus + project mentioned above, which involves an evolution of Project-Based Learning, in accordance with constructivist pedagogical principles where knowledge is actively built by the student, being in movement and constantly changing, incorporating it through instruments of study and theoretical-practical assimilation such as project development (Carretero, 1993).

The BPI methodology has been developed with the training of students who have difficulties in developing all their skills towards a professional career that is satisfying, rewarding and in which they feel that they contribute effectively to their social environment.

There are multiple factors that can be a barrier to a student's education and full social and labor integration, personal, family, economic, or social barriers.

Training centres located in disadvantaged areas (neighbourhoods, municipalities or regions) have to take into account in their teaching methodologies that their students are unlikely to have little family support in their studies and that the social environment will not particularly value the effort devoted to training either.

We believe it is essential to develop methodologies that nip in the bud the vicious circle of lack of prior training, lack of self-esteem, lack of recognition and delay in training, especially in disadvantaged environments from which we cannot expect to have much help in the education of students.

On a personal level, physical or psychological barriers and socioeconomic barriers produce a delay in training, which is in itself another barrier whose effect (and at the same time cause of educational failure) is demotivation and lack of self-esteem.

On the other hand, students who belong to socially, economically and culturally advantaged backgrounds have access to very attractive and motivating training possibilities: their own family help, extra language classes, internships, exchanges and stays abroad. A student with personal limitations in a privileged environment has various aids to enable him to get the most out of himself.

We believe it is essential to develop methodologies that nip in the bud the vicious circle of lack of prior training, lack of self-esteem, lack of recognition and delay in training, especially in disadvantaged environments from which we cannot expect to have much help in the education of students. The BPI methodology aims to go in this direction by proposing an activity in the work environment based on the following aspects:

A contact with the company at the beginning of the VET studies

The first point raised in the BPI methodology is that a work experience in a real environment at the beginning of vocational training, if it is positive, is extraordinarily motivating for future studies at the VET centre. Especially in disadvantaged environments, we consider bringing work experience to the classroom because it is an environment of trust for the student who is going to carry out collaborative work with other colleagues.

A creative experience

We set students a realistic and really interesting goal on the way to developing a new product or process. The reluctance in this regard is understandable: what will a group of teenagers who are starting vocational training be able to contribute to the company? It is clear that the success of the experience will have a lot to do with the company's ability to propose projects related to products or processes that are real and at the same time accessible to students. Throughout this guide we will look at some examples raised by the companies participating in this consortium and that we think meet both aspects.

Tasks that allow each student to show their talent to themselves and their group

We consider it essential to provide a new situation with respect to the previous educational stages, a rupture with respect to the scale of values of traditional education and the social environment. A situation where aspects that are perhaps less valued in the educational environment and that are nevertheless extraordinarily valuable in the work and social environment are highlighted: creativity, assertiveness, communication skills, leadership, responsibility, camaraderie, critical spirit...

A way of working that encourages the learning of teleworking techniques that will be fundamental in the professional lives of students

A motivating work experience that encourages you to go further in training

Recognizing all the difficulty involved, educational programs should be aimed at making the student want to acquire those skills that he or she has seen that he or she is far from mastering, but that will be valuable and worth the effort to acquire.

A satisfying experience

It is a point that must be considered carefully. There must be a balance between all those skills that the student sees that he needs and that he does not master and those others that the student can see that he does have without being aware of it or that he can acquire in a short period of time.

A project posed as a challenge for the classroom as a whole

or for large groups within the classroom, with what this may mean in terms of the awareness of belonging to a group and the response in relation to co-responsibility.

A way of interacting with a foreign company or with foreign VET training centres

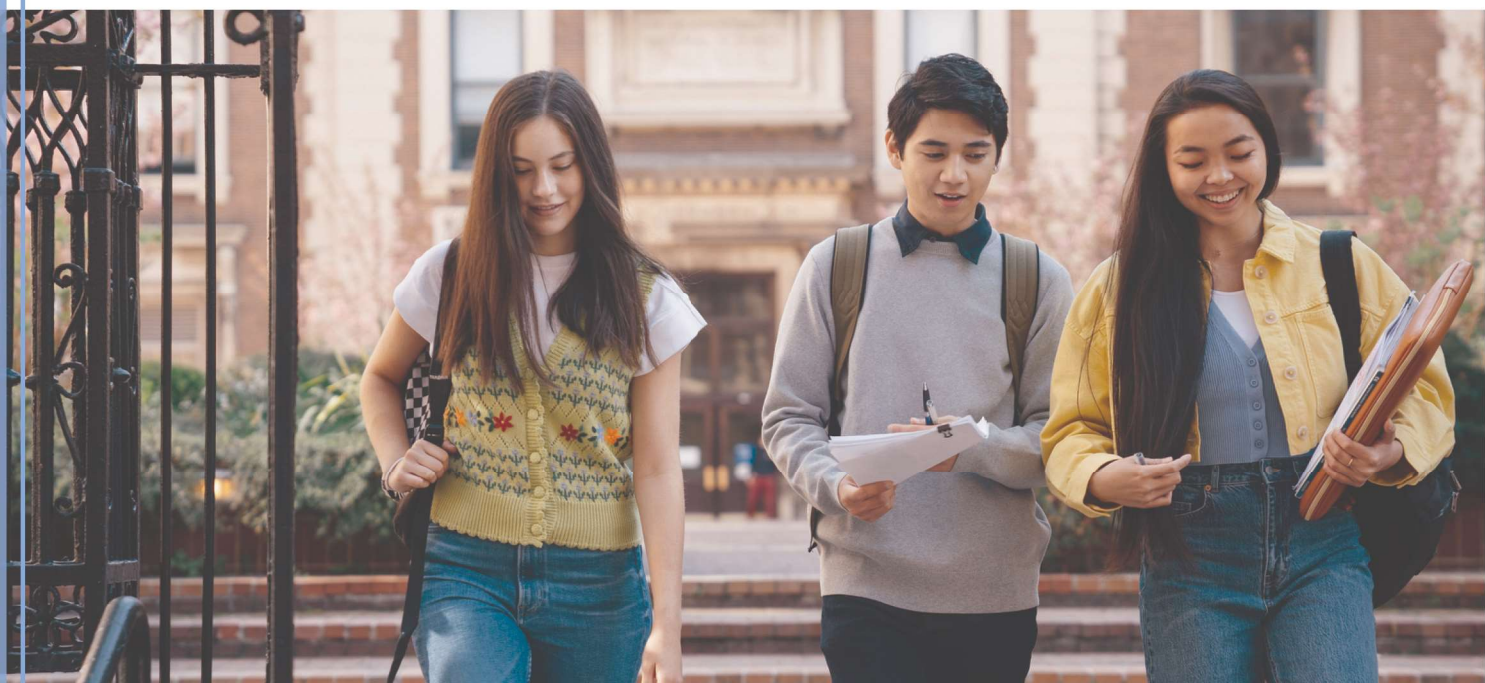
The project, which is part of a European network within the framework of the Erasmus+ programme, allows students and companies from different European countries to be involved in the project

Una forma diferente de relacionarse entre estudiantes y con profesores y profesionales de empresa

The innovation of our proposal lies in the fact that the classroom of the Vocational Training Center becomes a virtual department of the technology company. The students, working in groups and with company techniques for the organization of work will develop important parts of a company research project.

We intend that our methodology brings to vocational training students the experience of working in a work environment, in a technology company. Not only that, we intend to do it without complexes, making the most of the work led by professors and company professionals, even taking full advantage of the advantages that our methodology may have over face-to-face internships. The methodology focuses mainly on the development of transversal skills that can have an important impact during subsequent studies and on the employability of students once they graduate.

This system implements in the classroom the use of task management and distribution software used by technology companies in order to define tasks, schedule them and integrate them into the work times of the rest of the company's departments. Through networking, students and the school will be participants in future products that reach the market. At the same time, many of the collaborative work tools, developed in project-based learning methodologies, are applicable.



The implementation of the BPI methodology is designed for vocational training in the scientific and technological branch, such as Computer Science and Communications, Electronics and Electricity, Chemistry or Imaging. We believe that the first year of these vocational training is the most appropriate for their implementation, since, as we have said before, students will acquire cross-cutting knowledge and skills from the beginning of their studies that will be key to their training and access to the labour market.

Our educational methodology focuses on students developing transversal skills related to autonomy in lifelong learning, group work, leadership, effective oral and written communication, definition and fulfillment of objectives and critical thinking applied to science and technology

The practical implementation of the methodology could be as follows: A VET centre reaches an agreement with a technology company to implement the BPI method in its first-year classroom; After signing the confidentiality and authorship documents, the teacher will begin to participate in meetings with department heads of the company, where they will learn about aspects of the project and the work plan created by the company, allowing them to assign specific tasks for their students.

The students in their classroom will have access to the "Techvetlab" management programme, developed within the framework of the Erasmus+ project mentioned above, where they will be assigned the processes and times in which they must jointly develop the tasks of the established work plan. Techvetlab is a completely free and innovative software compatible with that used by technology companies to control operational and production processes, but directly adapted to the characteristics and educational needs of VET students. Through an intuitive design, this software allows you to create an online project in which the technicians of a company, the teacher of a classroom and the students of the same will work as a team and coordinate their work.

Throughout the process, students will have to hold joint meetings as if it were their own department, as well as contact other workers in the company to carry out their work. On the other hand, with the work carried out by the students, the company's technicians will implement the experimental or prototyping components included in the project in their facilities.

Our educational methodology focuses on students developing transversal skills related to autonomy in lifelong learning, group work, leadership, effective oral and written communication, definition and fulfillment of objectives and critical thinking applied to science and technology. In the programmingof Erasmus Plus internships, companies and educational centers are used to the preparation of the learning agreement in which the activities that the student will carry out in an internship and the skills that are intended to be developed are very succinctly proposed. In the BEING A PART OF IT methodology, something similar will be needed, but it will be necessary to program in more detail, reflecting on how to adapt the company project to the reality of the work in the classroom and to the capabilities of the specific group of students involved.

But it can be anticipated that implementing this methodology will have to overcome significant difficulties that can ruin the objectives that are set:

- Will the resources of our VET centre be sufficient?
- Depending on the area of work, how far can you go in the classroom without access to industrial equipment?
- The number of students in our VET classrooms is very high, how do you organize the work of 25 people in a single project? Even if we divide it into subgroups, it is difficult to organize the practice by ensuring that all students take advantage of it and all contribute effectively to the work of the group.
- The level of knowledge and skills of different students can be very different within a classroom, let alone between classrooms in different schools in the same country or in different European countries.

All this means that both the company's project and the work plan in the classroom must be thoroughly prepared. A significant commitment will be required from the people involved and the proposed methodology must consider how to ensure that this work and this commitment is rewarded by the development of the project itself. The following chapters develop in detail how these ideas can be put into practice.

04

THE WORK PLAN

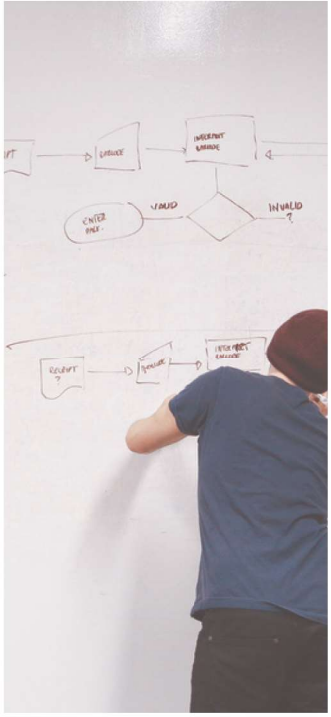
The BPI methodology requires that both the company's project and the classroom work plan be thoroughly prepared. A significant commitment will be required from the people involved and the proposed methodology must consider how to ensure that this work and this commitment is rewarded by the development of the project itself.

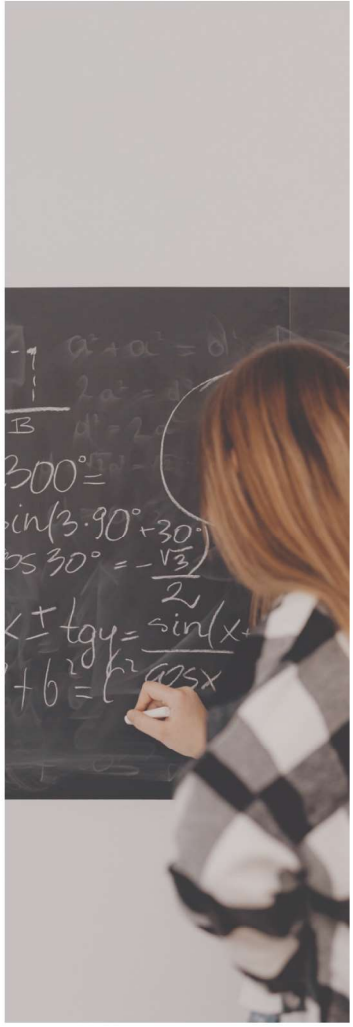
To help with the preparation of the internship, the working group of the Erasmus Plus project "TECHVETLAB" has prepared a template and some examples that can serve as a guide. On the one hand, it serves to collect all the aspects that we consider important, and on the other, to make those who prepare the project on behalf of the technology company and those who prepare the work in the classroom stop to think critically about their approaches.

GENERIC WORK PLAN MODEL

We have created a generic work plan model that can be adapted to any project in a technology company with the aim that company technicians and tutors from educational centers have the necessary mechanisms to turn a VET classroom into a virtual department of the technology company, in which students and teachers develop important parts of research projects.

4.1





OBJECTIVES OF THE BPI METHODOLOGY

The BPI (BEING A PART OF IT) methodology is a working method devised by experts linked to the project entities with the aim of enabling students to acquire skills through participation in research and development projects.

Through this method, the school and the technology company reach collaboration agreements that allow a classroom led by a teacher to participate in a technological research project as if it were a department of the company. This system implements in the classroom the use of task management and distribution software used by technology companies in order to define tasks, schedule them and integrate them into the work times of the rest of the company's departments.

The aim is for students, through participation in research projects linked to technology companies, to acquire training that stimulates critical thinking, creativity and initiative, while achieving autonomy and assuming their capacity for work.

Our educational methodology focuses on students developing transversal skills related to autonomy in lifelong learning, group work, leadership, effective oral and written communication, definition and fulfillment of objectives and critical thinking applied to science and technology.

4.1.1. DEFINITION OF THE PROJECT AND WORK PLAN

In the programming of Erasmus Plus internships, companies and educational centers are used to the preparation of the learning agreement in which the activities that the student will carry out in an internship and the skills that are intended to be developed are very succinctly proposed. In the BEING A PART OF IT methodology, something similar will be needed, but it will be necessary to program in more detail, reflecting on how to adapt the company project to the reality of the work in the classroom and to the capabilities of the specific group of students involved.

The objectives of the project in which the students are going to participate must be clear from the beginning, both for the technicians of the technology company and for the tutor and students of the educational center.

Although there is educational coherence in VET training curricula in the European Union, it should be borne in mind that there can be large differences between countries. For this reason, we recommend that the school and the technology company coordinate to establish the objectives based on the training of the students. Next, we will present some considerations and suggestions on the characteristics that we consider the project should have in order for it to be suitable for our methodology. Two important tools for project management will be the workbooks that each student will carry, in the form of a laboratory journal. It is prepared in such a way that when completing it, the student is forced to reflect on their results, their learning, the fulfillment of the specific objectives of each task and to put that reflection in writing. Similarly, we propose a template for the drafting of the project by the company, with a similar approach, and also a workbook for the teacher in the classroom where the day-to-day and progress of the work are collected. Needless to say, these reflections will be very useful for this methodology to improve over time as it is applied and learns from the accumulated experience. We will also talk about the computer and other tools required, proposals for the development of self-learning skills in students and critical thinking skills applied to technology.

4.1.1.1. The company's definition of the project

We can imagine projects on very different topics depending on the sector to which the company belongs. It is difficult to generalize when it comes to commenting on the characteristics that a project must have in order to be viable in the BEING A PART OF IT methodology. However, there are some essential points that need to be thought about in some detail when preparing a proposal.

The context of the company

Either in writing in the definition of the project or in the first meeting between the company and the students, it seems convenient to explain the context of the company, we recommend explaining the main characteristics of the company, detailing its production and lines of innovation, the projects it develops and in which it collaborates, even the departments that make it up, as a way of situating students. It will be motivating to show how useful the project will be for the company.

The teaching objectives of the project

The proposed project has a fundamentally educational purpose. The collaboration between the company and the educational centre in carrying out the practice in the classroom is aimed at training students in a series of transversal skills that we consider important so that they can direct their professional careers towards innovation. With this in mind, we can consider that the choice of the topic of the project itself is less important than the methodologies used to carry it out and that, consequently, there is no need to be afraid that the proposed project does not directly connect with the subject taught in the subjects involved, although we do want it to be able to capture the interest of students and teachers and that implies that the project is located in the context of the project. the field of specialization of the previous studies.

The level of difficulty

The background of the students in terms of the scientific and technical concepts involved in the project can vary greatly from one student to another, from one study center to another and from one country to another in the European Union. We do not believe that the key is that students have previously studied and mastered subjects specifically related to the problem they are going to be faced. In our teaching approach, we want to fight against the conception of vocational training as training for the performance of specific functions in a narrow range of companies. Students should see training at any stage of life as the acquisition of skills and abilities to face a professional activity that they have most likely not studied before. That's going to open up a huge field of possibilities for your career.

The practice we are proposing will surely show this character. It doesn't seem necessary or useful for us to look for the technology company that is perfectly suited to a particular curriculum. Rather it will be the other way around, the classroom will have to adapt to the project that is proposed to it in order to be successful.

This means that in the methodology applied to the development of the practice, it will have to be considered a first stage of training of the students in fundamental aspects of the technology that they will have to apply. It is essential that understanding and assimilating these concepts or acquiring the necessary skills is accessible to them and constitutes an initial barrier that discourages or makes them feel incapable. In fact, the main teaching objective is the opposite: we want students to see that they are capable of going beyond what they have studied so far. The close collaboration between the company's technicians and the teachers of the educational center will ensure a good definition of the project in this sense.

General objective and definition of specific objectives

The fact that the resolution of the problem that is proposed as the general objective of the project can be broken down into a series of specific objectives will be of great help to the organization of work in the classroom. It should be borne in mind that the project is going to be carried out by a group with a large number of students that should be organized into smaller work teams that are in charge of specific tasks. We will be interested in defining these tasks based on specific objectives that we can evaluate throughout the project and at the end. The division of labour will have to be combined with the responsibility to achieve the overall objective. Each team will be responsible for achieving its objectives and for the classroom as a whole to achieve the overall objective.

Adjust the degree of difficulty of the objectives

It can be an advantage in order to achieve the teaching objectives that the degree of difficulty of the project objectives can be modulated, that it is not an all or nothing. One idea may be to propose a general objective that is considered achievable and variants of improvement on that basic objective that can take further and that will be achieved or not depending on the evolution of the work in the classroom, the imagination of the students, their abilities, luck and so many other aspects that will influence the work of the group.

Presentation of results

The format in which the results of the project will be presented will be considered from the outset. Ideally, a single final report document with annexes. You can set its extension, electronic file format and server where it should be deposited. It is recommended that there is a shared folder accessible to both the classroom and the company where all the work documents are deposited correctly organized.

Throughout the execution of the project, work meetings and partial results will be held with the company. The frequency of these meetings, their duration, and the format for the presentation of results by the students should be fixed. One of the skills we want to focus on is effective communication, both orally and in writing. Setting short presentation times forces students to carry out an exercise of identifying the essential points of what they want to communicate and how to express them. Having a set time to raise any doubts or questions that arise with the company's tutor also makes it necessary to prepare important questions in advance and to be effective in communication.

Evaluation

The evaluation of each student in practice will be carried out by their teacher in the classroom. Additionally, the company may be interested in interviewing those students who have shown special leadership in the project with a view to future face-to-face internships or internship contracts.

Below is a template that can capture all these aspects and can serve as a guide for the company's technicians who define the practice they propose.

PART 1.- Project plan (to be completed by the company)		
A. Title:	**B. Shared Folder/Server**	**C. Duration:**
D. Brief description. Technical problem raised.		
E. Area or project of the company in which it is framed.		
F. General objective of the internship and possibilities to go further: How far are students expected to go in solving the problem posed?		
G. Specific Objectives. How can the general problem be broken down into several more specific problems that the teacher in the classroom can assign to different sub-working groups?		
H. Necessary Equipment.		
I. Form of relationship between the classroom and the tutor in the company: Frequency of meetings. Presentation of the progress of the project. Duration and agenda of meetings.		
J. Format for presenting the final results and conclusions of the work carried out in the classroom to the company.		
K. Initial information that the company can give to students about the proposed project. *Include the pages you need*		

4.1.2. Detailed work plan

We propose a work plan divided into 3 phases (preparation, execution and completion) in which a set of tasks will be developed that will allow students to participate in a project of a technology company. In this generic work plan we wanted to propose a set of generic tasks that we believe should be complemented and adapted with specific tasks of the project to be carried out. The total duration of this work plan is planned for the participation of a vocational training classroom in a project of a technology company for two months.

We consider it important that each phase includes an initial description, the objectives of the phase and its total duration. The times indicated below are indicative.

Phase 1: Preparation

Objective: This phase aims to ensure that students understand the project and have a clear idea of the characteristics of the work to be carried out.

Description: Throughout this phase, students will carry out three tasks in which they will understand what the project in which they are going to participate consists and will be trained in the software they are going to use.

Tasks: We propose the following tasks to achieve the objectives of this phase, which can be complemented and/or adapted by each company to fit the project to be carried out.

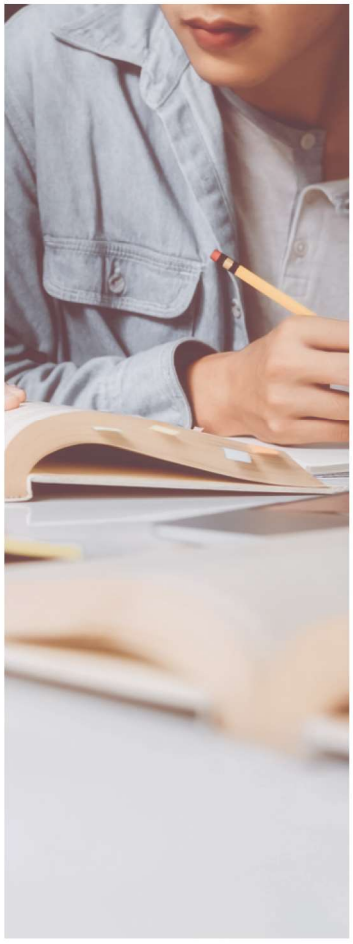
- **Recommended Task 1.** Understanding of the project. At the beginning of this stage, we propose to hold a team meeting in which the members of the company in charge of the project explain to the students the project in which they are going to participate, as well as its main characteristics. This will be a first contact in which students will get to know the team of the technology company with which they are going to work.

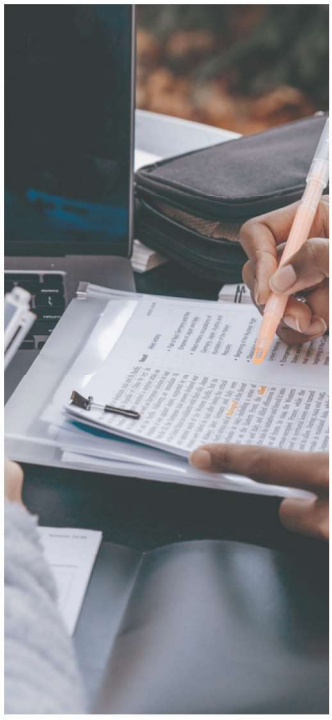
- **Recommended Task 2.** Training in work tools. The teacher, with the help of the company's technicians, will train the students in the use of the Techvetlab management software, the communication software chosen by the company for sending emails and holding virtual meetings and the work software chosen to carry out the main activities of the project. To do this, the teacher will use the list in sections 2 and 3 of the work plan developed by the company.

- **Recommended Task 3.** Installation of the work software. Once the students have understood how the software works, they must proceed to install and use it.

- **Recommended Task 4.** Training for the development of the Workbook. Since students will have to write the Workbook on a daily basis as a tool for monitoring and developing critical thinking, we believe it is advisable that the technology company be in charge of explaining to the teacher in detail what it consists of and how it should be filled out. This task will consist of a virtual training meeting in which the company's tutor explains to the teacher each of the sections of the notebook, using examples and resolving any doubts that may arise. After this meeting, the teacher will explain to the students in the classroom how the Workbook should be developed.

- **Recommended Task 5.** Analysis and search for information. Students will have to analyze the project and its objectives. To do this, they should look for information on similar products that exist on the market as well as references on the different materials they will need. Deliverables: A document that compiles all the information collected.





Phase 2: Execution

Objective: at this stage the objective is for the classroom as a whole to develop the main activities for the development of the project.

Description: The second stage is the longest, as well as the most important, as it is the one in which the main activities to create the project will be executed.

Tasks: We recommend a series of activities that can be used and should be complemented with those that are more concrete and specific to the project to be developed.

- **Recommended Task 1:** Preliminary design. We recommend that the first task for the execution of the project is the creation of a preliminary design, as it will allow students to analyze important aspects of the project and develop critical thinking. Once this design has been made, we consider it important to hold a team meeting in which they present the design to the company's team.
  Deliverables: Preliminary design and Presentation

- **Recommended Task 2:** Preliminary Design Analysis. After the presentation of the preliminary design, we consider it important that the students analyze the comments made by the members of the technology company and make the appropriate changes. We recommend holding a team meeting again to present the changes so that they can be analyzed by the company before making the final design.
  Deliverable: Preliminary design with the changes implemented and Presentation.

- **Recommended Task 3:** Final design. After completing the recommended tasks, the students will carry out the final design of the product that they are going to develop for the project and will be able to start developing the specific tasks.Once the final design is done, we recommend that a virtual meeting be held with the company's team so that they can assess and approve it.
  Deliverables 1: Final design and Presentation.

We recommend that the same scheme that has been used to specify the fundamental aspects of each activity be used to specify the specific tasks of the project to be carried out. We therefore propose to indicate:

- Title of the activity.
- Equipment needed to carry out the activity.
- Duration.
- Description.
- Deliverables. Those documents, files or designs resulting from the task that must be delivered to the teacher and/or the company's technicians to be analyzed and evaluated.

We consider it important that during this phase periodic team meetings are held and between the teacher and the tutor of the company that allow the monitoring of the project, as well as that the students work together with technicians of the company and have a full and really useful experience for their training and their future work.

Phase 3: Completion

Objective: this phase aims to reflect and develop critical thinking through the creation of a final report and the presentation of the work done to the company.

Description: Once they have carried out all the activities of phases 1 and 2, the students must prepare a final report detailing the results they have obtained and the set of activities they have carried out during their participation in the project.

These reports, which can be made individually or in groups (depending on the teacher's choice) will allow students not only to be evaluated by the teacher, but also to understand and analyse the work done, together with the Work notebook.

Finally, they will prepare a presentation to explain the work they have done to the company's team.

Work plan template:

PART 2.- Detailed Work Plan			
PHASE 1. Preparation			
Task 1.1.	**Team:**	**Duration:**	**Deliverables:**
PHASE 2. Design & Construction			
Task 2.1.	**Team:**	**Duration:**	**Deliverables:**
Task 2.2.	**Team:**	**Duration:**	
PHASE 3. Conclusions. Final Report			
Task 3.1. Drafting of the final report.	**Team:**	**Duration:**	**Deliverables:**
Task 3.2. Verification of the final documentation deposited in the project folder	**Team:**	**Duration:**	**Deliverables:**
Task 3.3. Preparation of the final oral presentation of the project	**Team:**	**Duration:**	**Deliverables:**

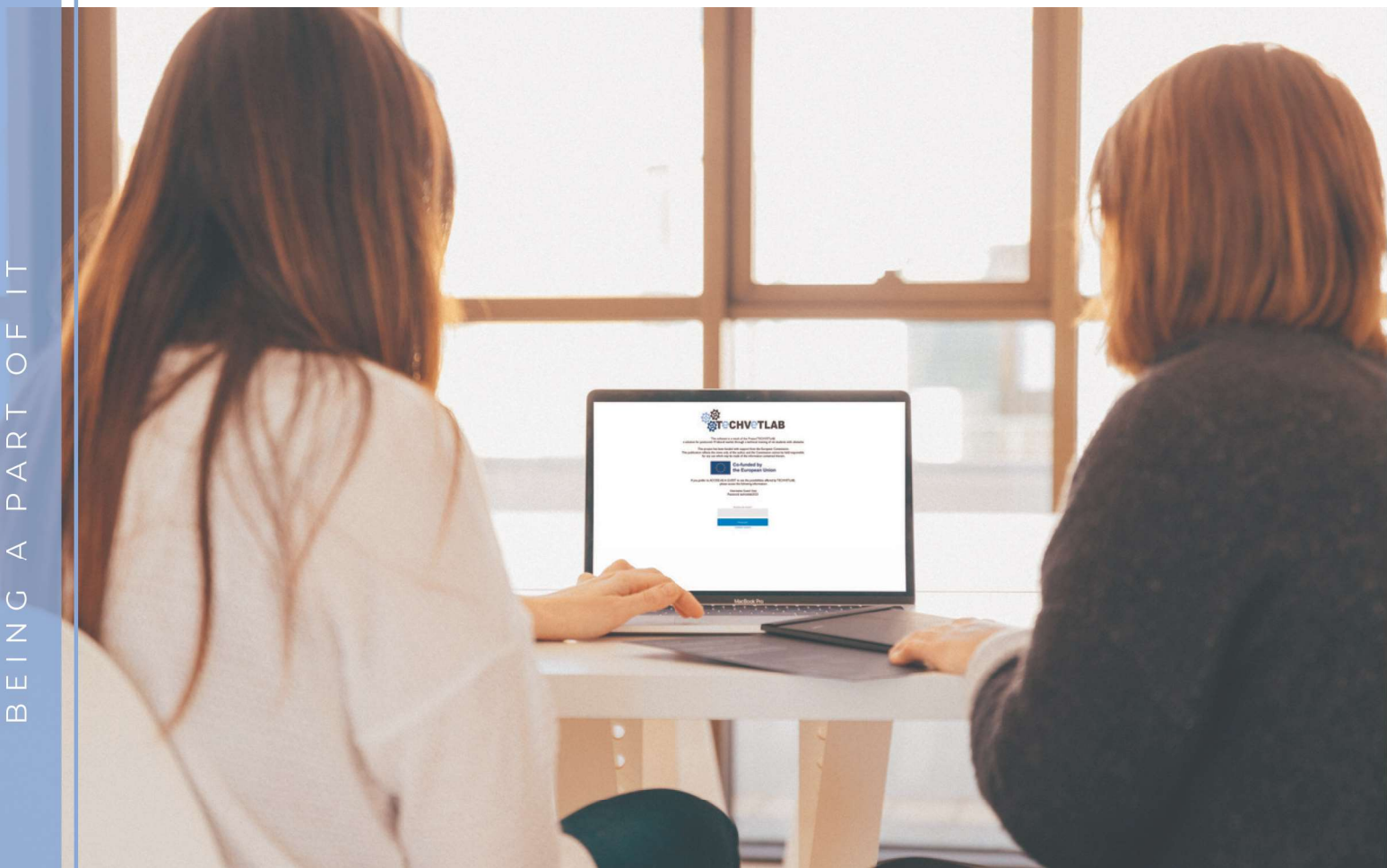
4.1.3. Management tools: TECHVETLAB SOFTWARE

The educational management software "TECHVETLAB" has been created within the framework of the Erasmus Plus project "TECHVETLAB: A SOLUTION FOR POSTCOVID-19 LABORAL MARKET THROUGH A TECHNICAL TRAINING OF VET STUDENTS WITH OBSTACLES." by experts from technology companies and vocational training centers with the aim of coordinating teamwork between the classroom and the company. as well as teaching students the methods and tools of business management and time control, developing transversal skills and establishing logical analyses.

TECHVETLAB is a completely free and innovative software compatible with that used by technology companies to control operational and production processes, but directly adapted to the characteristics and educational needs of VET students.

Through an intuitive design, this software allows you to create an online project in which the technicians of a company, the teacher of a classroom and the students of the company will work as a team and coordinate their work.

Section 6.1. In this guide you can access the information about the Techvetlab software, as well as learn about its main functions.

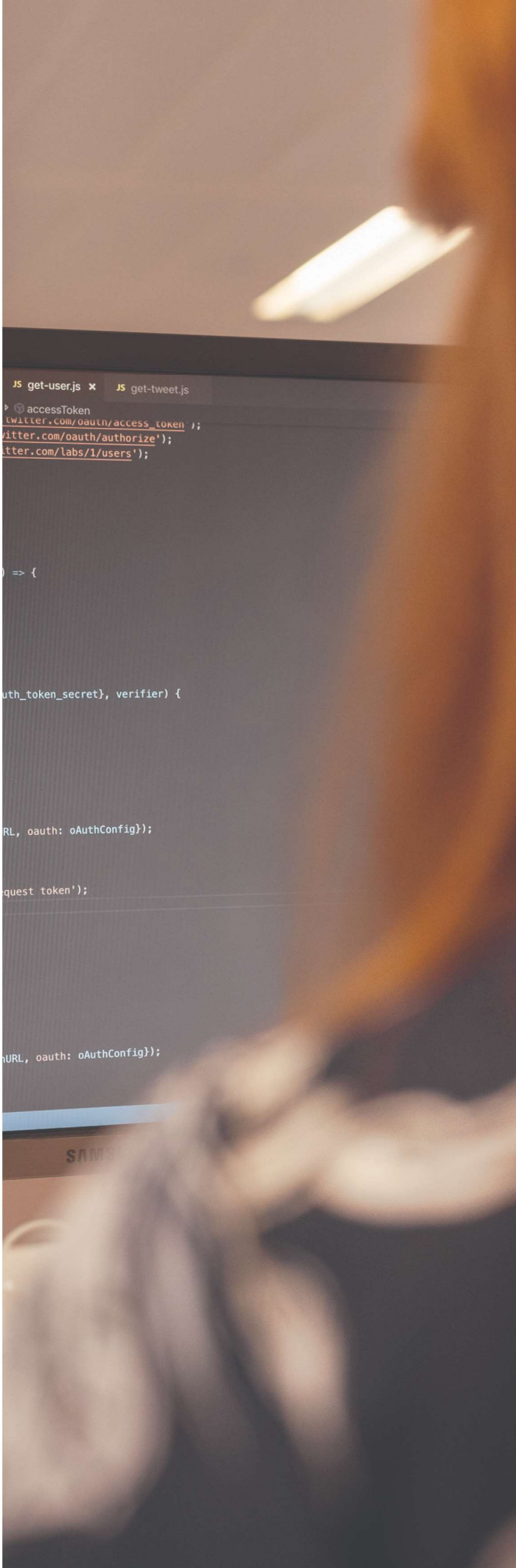


4.1.4. Free software for the development of the project

Throughout the participation in the research project, it will be necessary for students to use software packages that allow them to carry out the tasks entrusted to them. In order for everyone to have access to the same programs and not to involve an extraordinary cost for the center, free and open software will be chosen; Free software is software that can be studied, modified and used freely for any purpose.

In order for all students to be able to actively participate in the project, it is necessary for them to master the management of the main programs they will need. In this way, you will be able to distribute the work more effectively and you will be able to work better as a team.

On the one hand, the company must provide the school tutor with a list of all the software that the students are going to use, along with a short explanation so that the teacher, if they do not know these programs, has a notion of what they are going to use, as well as download links and user manuals for each of these programs.



4.1.5. Communication Software

Fluid and stable communication is essential both for the correct development of a project and for teamwork, which promotes critical thinking and generates a spirit of learning and collaboration that is key to working in multidisciplinary teams.

During the participation of the students in the project, it will be necessary to hold virtual meetings between both the teacher and the tutor of the company and between all the members of the team participating in the project.

To do this, we recommend determining the tool to be used in advance. We consider it important that it is free (or at least has a free plan) and free access so that all students can use it without the school having to invest in extraordinary expenses.

There are a lot of softwares to hold virtual meetings. However, we propose the following:

- Skype. It is a widely known free software that allows you to make one-on-one and group audio and video calls, as well as communicate via chat. It is a very useful software for carrying out team meetings, since it also has the functionality of sharing the screen of your device, making it easier for students to show their work to the team and for technicians and teachers to make explanations in a simple way.

- Zoom. It is a video conferencing and chatting software that has a free plan that offers to hold meetings with a limit of 100 participants and a maximum duration of 40 minutes per meeting. In addition, meeting participants have the ability to share their screen.

4.1.6. Follow-up tools: THE WORK NOTEBOOK

The project notebook is a daily work and monitoring document whose structure allows students to develop the key competences of critical thinking, while the teachers and workers of the company keep track of the daily work carried out by each student.

Thanks to this document, students reflect and critically evaluate the tasks they are carrying out, which allows them to understand the project as a whole, solve problems and develop essential aspects to be able to work in a technology company.

To this end, the project notebook is structured in three different parts in which each student will detail the tasks in which they participate while developing all the key competences of critical thinking.

To this end, the project notebook is structured in three different parts in which each student will detail the tasks in which they participate while developing all the key competencies of critical and scientific thinking.

It is important that students become familiar with this Workbook, because if in the future they carry out virtual or face-to-face internships of the network, it will be a document that they will have to fill out day by day.

For this reason, it is recommended that a training session be included in the work plan in which you explain to students how they should use this notebook, indicating examples that allow them to understand how to fill it in.

In section 10.2 of this guide you will find all the information, structure and template of the laboratory notebook.

4.1.7. Meetings

These meetings are important, both to maintain fluid communication between the classroom and the company, as well as to discuss important issues of the project, resolve doubts and discuss certain aspects.

On the one hand, we recommend that meetings be held between the teacher and the tutor of the technology company to specify details and analyze the progress of the project.

On the other hand, there will be group meetings, in which, in addition to the above, students will participate. In these meetings, they will not only present their work, but they will also be able to work as a team with the technology company's technicians.
In order to hold these meetings, we propose to establish the following aspects:

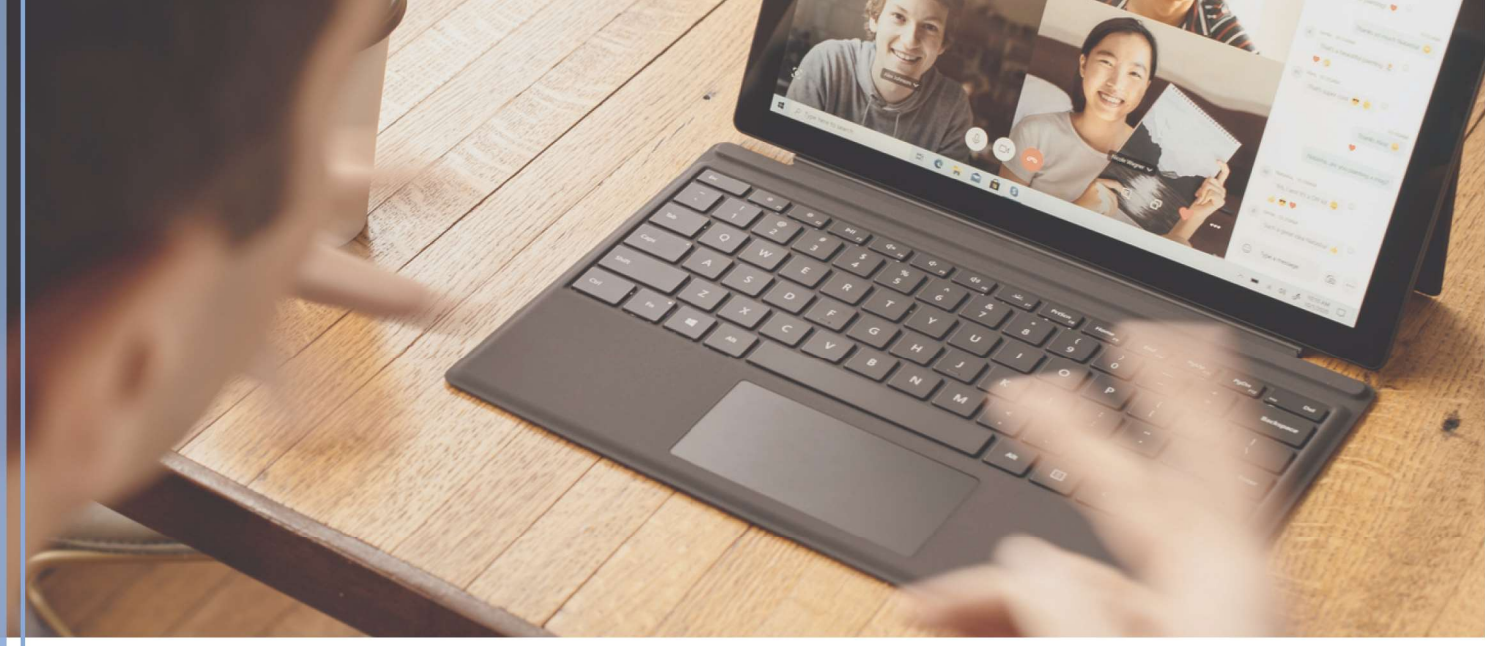
- **Agenda**. It is important for participants to be able to prepare in advance the material they will need and the topics to be discussed.

- **Schedule of the meeting**. We recommend that meetings with students coincide with class time so that they can attend without any inconvenience. On the other hand, meetings with the teacher are recommended to be held during both working hours, but outside the classroom.

- **Duration of the meeting**. We recommend that the duration of the meetings does not exceed 1 hour, both so that they are dynamic and do not interrupt the work of the company, and because it is the generic duration of the students' classes.

Meetings between the company's tutor and the school's teacher.

In these meetings, the teacher will explain to the company's tutor the status of the project in order to carry out an analysis and follow-up of it. In addition, these meetings will allow details to be worked out and adjustments to be made that may be necessary.



Meetings between the entire work team (the teacher, the students and the team of the technology company that is going to participate in the project).

They consist of meetings attended by all the people involved in the project (teachers, students and staff involved in the company). Because the classroom functions as a virtual department of the company, these meetings will be held virtually.

Therefore, during these meetings, students must present the progress of their work and the results obtained to the company team so that they can be evaluated as a team and, in case problems have arisen, they can be dealt with and solutions can be sought.

We recommend holding meetings weekly to have specific topics to talk about and maintain frequent contact with students.

smallcodes

WORK PLAN
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4.2

BEING A PART OF IT

PART 1.- Project approach (to be filled in by the company)		
A. Title: Construction of a simple web page from scratch using HTML and CSS	**B. Shared/Server Folder**	**C. Duration:** 2 months 5 hours/week

D. Brief description. Technical problem raised.

HTML (HyperText Markup Language) and CSS (Cascading Style Sheets) are the two most important languages for a new web developer to learn and provide the basic knowledge for building webpages.

Every webpage on the internet is built using code. There are many different programming languages that can make website do various things, but the two most important to learn are HTML and CSS. In fact, even people who plan on specializing in another type og coding should have at least a basic knowledge of both languages.

As in many companies, by now programmers can make use of complex technologies, and often the way may be to rely on no-code programs, nevertheless in order to act effectively at any level on a webpage or application, it is necessary to possess the basics of these two languages.
Therefore our objective within this project is to provide new developers with the minimum knowledge required to be familiar with coding, in order to test their ability in building simple webpages.

In our case the pages to be created will be a series of **landing pages for a bike tour operator**, our client, within their marketing campaign in the launch of new products. The graphic appearance of these pages should therefore accord with the style of the main site but at the same time show elements of innovation. All information necessary for the sale of products should be contained in the pages. The company will provide the texts and images, but student groups will be left free to study an original way of arranging them.

E. Area or project of the company in which it is framed.

The work of our company is classified in the area of software development, and therefore all our programmers have a basic knowledge of the two languages that are the subject of this project.
Then in detail, each of them specialized in other genuine and more specific programming languages at a later stage.

Our software development always starts form HTML files, and this is the way we begin structuring our web pages' content. In a second stage, we add CSS styling in order to accommodate our customers' requests in terms of graphic appearance.

F. General objective of the practice and possibilities to go further: How far are students expected to go in solving the problem posed?

General objective: the students will be asked to arrive at the final result that is a series of index.html files that reproduces the conceived landing pages. During the preliminary phase we will offer our contribution through a basic HTML and CSS introductory course in which all the key points of these languages will be exposed and listed.

In this way students will know how to use these elements to get to the final goal.

Collateral objectives: During the construction of the webpages all or most of the notions learned will be used in order to test students' ability to collect all the bricks formed during the training phase and put them into practice. Our goal is to identify among the students those who are most likely to perform easily this type of work and also those who are most talented in web designing.

G. Specific objectives. How can the general problem be broken down into several more concrete problems that the classroom teacher can assign to different sub-working groups?

First, each sub-group will be assigned a product to launch in the marketing campaign so that they can devote themselves to the specific landing page. Of course, the whole class together with the teacher will have to agree on the general graphic line to be kept, but customizations will be possible since the landing pages can even differ from each other.

Furthermore, within each sub-group the professor or tutor will be able to distinguish between those students who like more the constructive part, and therefore HTML, and those who prefer the graphic aspect and therefore CSS. Consequently, the teacher may assign more specific tasks according to students' inclination.

H. Necessary equipment.

PC
Internet access
Gimp or other image editor
HTML editor such as:

- CoffeCup
- Atom
- Visual Studio Code
- ... or others

I. Form of relationship of the classroom with the tutor in the company: Frequency of meetings. Presentation of the progress of the project. Duration and agenda of meetings.

The meetings of the company tutor with the classroom teacher will not be scheduled, a continuous communication channel will be opened through TECHVETLAB application, according to everyone's availability.
In this way, it is expected that any questions or problems that may arise will be resolved in the shortest possible time.

A virtual meeting between the tutor and the classroom should be scheduled every 15 days. During these meetings, one student from each team will present the progress of the tasks assigned to his or her team in the project. After that presentation there will be a discussion with the company tutor and the whole team will have the possibility to ask the tutor about any doubts that have arisen or problems the class have encountered.

J. Format of presentation of the final results and conclusions of the work carried out in the classroom to the company.

The result to be provided will be a series of index.html files with relative folders containing images and style sheet(s).
The files will constitute the different landing pages, ready to use for the company in launching its marketing campaign.

K. Initial information that the company can give to students about the proposed project.

The company will provide a basic course of HTML and CSS coding that will enable student to start with some basic knowledge. The course will be given in the form of folders containing examples of HTML files and read-me documents briefly explaining the topic of each chapter of the course.

In general, students will learn that:
- HTML contains tags that organize and structure text, include images, create forms & tables, and link to other documents or web pages all across the Internet;
- CSS is a series of rules that allow the author of a web page to specify formatting & presentation of HTML elements.

The different elements being part of these technologies will be examined in detail.

PART 2.- Detailed work plan We propose the work in the classroom to be carried out by 4 teams, thinking of a classroom of 20 to 25 students. It can be rearranged to fit a smaller or larger number of teams.		
PHASE 1. Preparation		
Task 1.1. **Title:** HTML – Basic elements of HTML **Description:** Introduction of the technology; Study of the operation of elements such as attributes, images, forms.	**Team:**	**Duration:** Week 1
Task 1.2. **Title:** HTML - Further concepts **Description:** Introduction of the concept of class and ID	**Team:**	**Duration:** Week 1
Task 1.3. **Title:** CSS – Basic elements of CSS **Description:** Introduction to the use of style sheets; Study of different selectors	**Team:**	**Duration:** Week 2
Task 1.4. **Title:** CSS - Positioning **Description:** Study and practice of relative and absolute positioning, learning the difference between the two	**Team:**	**Duration:** Week 2
PHASE 2. Design and construction		
Task 2.1. **Title:** Presentation of client's products **Description:** Products of the marketing campaign will be introduced to the class and the teacher will form the different groups according to students' interests and proclivity	**Team:**	**Duration:** Week 3
Task 2.2. **Title:** Collection of texts and graphical materials **Description:** The company will provide the original material to be used in the landing pages, but students will have the opportunity to freely propose extra materials if they wish	**Team:**	**Duration:** Week 3

Task 2.3. **Title:** First draft in Photoshop **Description:** Groups will create graphic templates for rendering landing pages using an image editor. The company will provide feedback.	**Team:**	**Duration:** Week 4
Task 2.4. **Title:** Transfer in HTML **Description:** Taking into account the feedback from the company, students will make a first draft of the index.html file with relative style sheet that will be the starting point for the landing page	**Team:**	**Duration:** Week 5 - 6
Task 2.5. **Title:** Extra CSS customisation **Description:** Any additional customizations to the CSS will be made at this stage	**Team:**	**Duration:** Week 7
Task 2.6. **Title:** Presentation of results **Description:** During a meeting, the groups will show their achievements	**Team:**	**Duration:** Week 7
Task 2.7. **Title:** Company's feedback **Description:** The company will send a series of feedback with any requests for changes	**Team:**	**Duration:** Week 8
Task 2.8. **Title:** Revision and new release **Description:** Students will accommodate requests and make appropriate adjustments.	**Team:**	**Duration:** Week 8
PHASE 3. Conclusions. Final Report		
Task 3.1. **Title:** Final report **Description:** Drafting of the final report by both parts	**Team:**	**Duration:** Week 8
Task 3.2. **Title:** Final documentation **Description:** Verification of the final documentation	**Team:**	**Duration:** Week 8

documentation deposited in the project folder: Final Report, 3D files of each part, GCODE files.		
Task 3.3. **Title:** Oral presentation **Description:** The groups will briefly present the knowledge learned, the methodologies applied and the results obtained	**Team:**	**Duration:** Week 8

Management software

For the management of the project, the educational management software "TECHVETLAB" has been created within the framework of the Erasmus Plus project "TECHVETLAB: A SOLUTION FOR THE POST-COVID-19 LABOUR MARKET THROUGH A TECHNICAL TRAINING OF VET STUDENTS WITH OBSTACLES" by experts from technology companies and vocational training educational centers with the aim of coordinating teamwork between the classroom and the company, as well as teaching students the methods and tools of business management and time control, developing transversal skills and establishing logical analyses.

TECHVETLAB is a completely free and innovative software compatible with that used by technology companies to control operational and production processes, but directly adapted to the characteristics and educational needs of VET students.

Through an intuitive design, this software allows you to create an online project in which the technicians of a company, the teacher of a classroom and the students of the same will work as a team and coordinate their work.

Free software for the project development

- CoffeeCup HTML Editor (or other html WYSIWYG editor)

It is a software for HTML or CSS editing that allows users to both create them from scratch and use designs with an existing theme.

- Gimp

GIMP is a free graphic design software for photo retouching, image creation, and compositing. This software allows you to create graphic design elements, icons, etc., transform images, use functions for color management, upload and save files in different formats... In addition, it provides the necessary tools for image manipulation (retouching, restoration, composition...) and is compatible with C, C++, Perl, Python and Scheme, among others, as well as file formats such as JPEG (JFIF), GIF, PNG, TIFF among others.

SOMATICA
MATERIALS & SOLUTIONS

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4.3

BEING A PART OF IT

PART 1.- Project approach (to be filled in by the company)		
1. Title: Simulation and Design of an Electronic Circuit	B. Shared/Server Folder	C. Duration: 2 months

D. Brief description. Technical problem raised.

An electronic system is usually constructed by the assembly of many circuits, which each represents a small component of the whole device. Thus, in this case, we'll be simulating, constructing, probing and designing a possible PCB for filtering circuits, which receive a sinusoidal input signal, and outputs the filtered signal in the other end of the circuit. A target application could be a sensor output signal that has a sinusoidal response, which is intended to be read by an analog-to-digital converter (ADC), where the sensor information is stored at a known frequency. However, sometimes the signal is contaminated by noise from many sources, such as sensor material components, grid noise or neighboring devices. Thus, an interface circuit must be applied in-between the sensor and respective ADC, which will provide digital control with the information provided by the sensor. During this course, the project to be performed will follow three main events:

- Filtering circuit selection and simulation;
- Breadboard circuit construction and probing with amplifier DC powering, signal generation and oscilloscope measurement;
- PCB design of the circuits employed;

Finishing with a small report, where students should write an essay about electrical signal filtering, what types of filters exist, and what each is used for. Further, a previous proper understanding of how signals with noise, are a result of a sum of many contaminating frequencies, should be carried out.

E. Area or project of the company in which it is framed.

This project is framed in the development area of keyboards and keypads for the industry, of *Somatica, Materials & Solutions*.

Somatica is a technology based-company, created in 2007 as a spin-off of University of Minho, from the Physics Department. The main goal was to develop electroactive materials to produce sensors and actuators. A few years later the company started to

dedicate to the development and commercialization of keyboards and keypads for all industries, using different materials and technologies, as well developing electronic interfaces between human and machines (HMI).

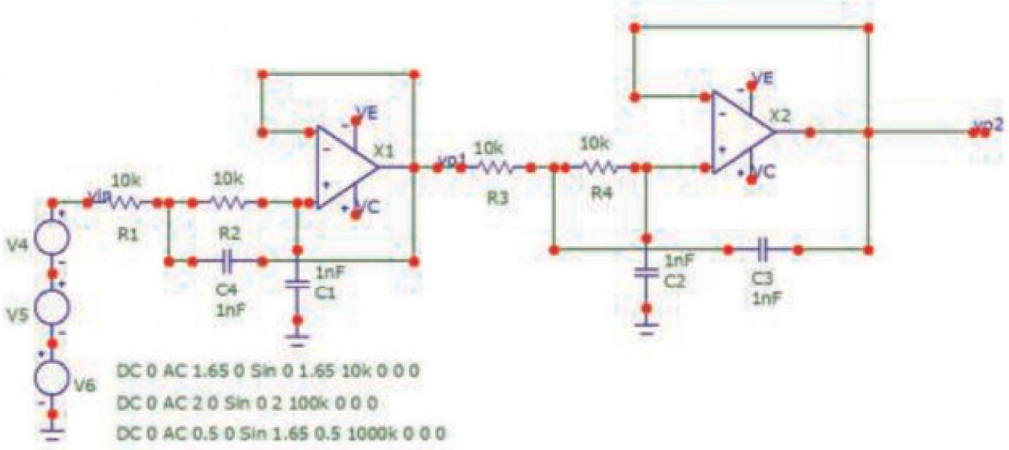
F. General objective of the practice and possibilities to go further: How far are students expected to go in solving the problem posed?

After this workshop, it is expected that the students are able to know how to prepare themselves in order to arrange and simulate a simple filtering circuit design by adjusting passive components such as resistors and capacitor values, and topology and checking automated tools in order to acquire circuit information.

G. Specific objectives. How can the general problem be broken down into several more concrete problems that the classroom teacher can assign to different sub-working groups?

I. SIMULATION

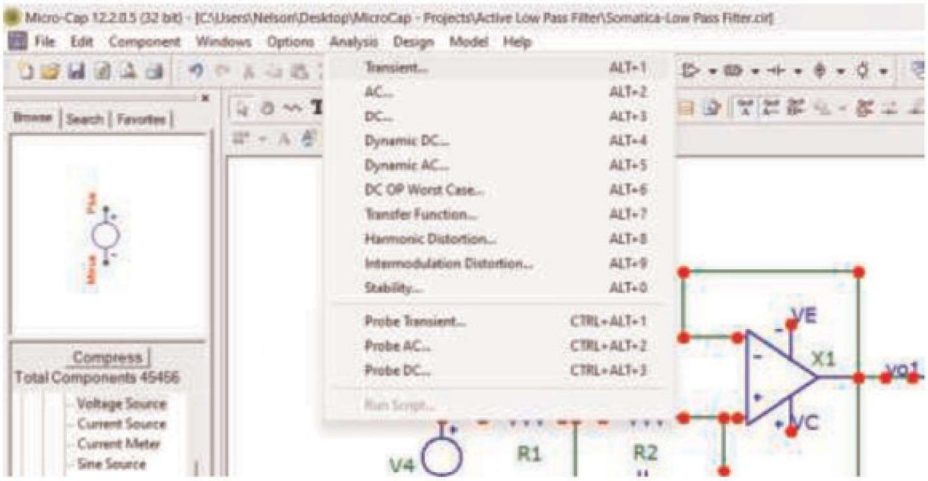
Students must seek online and use an open-source simulation spice software, such as the one suggested: *Micro-Cap 12*, and build a circuit such as the one below (Lowpass Filter - 3rd order Bessel):



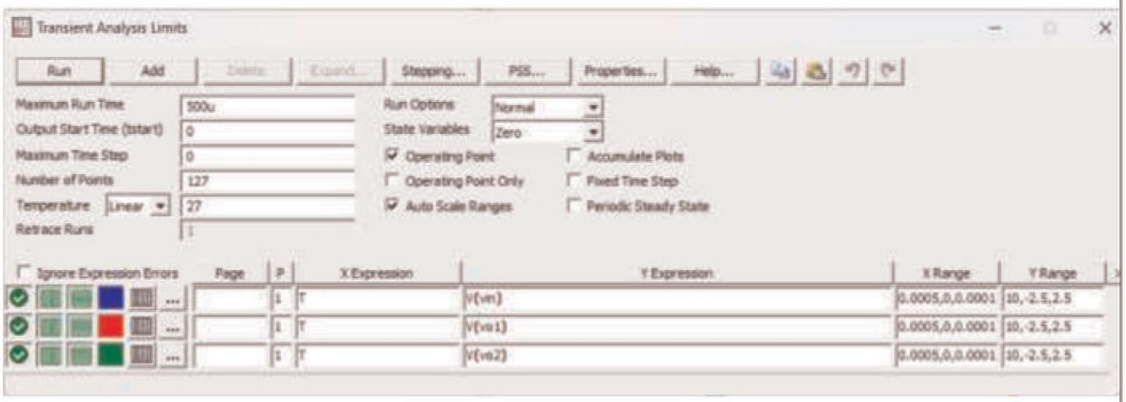
1. FilterType lowpass
2. FilterResponse Bessel
3. FilterOrder 3.0
4. FilterTopology Single Pole
5. NumberOfStages 2.0
6. PassbandFrequency 40.0 k

The components should rely in common use amplifiers such as LM741, even though there are better grade or more suitable references, the inexpensive nature of this reference and overall operation are very suitable for lecturing. The students should probe many signal frequencies, such as the ones in the picture, where the voltage sources (V4, V5, and V6) represent different signal frequencies, which is summed in a single signal and the information is stored at the 10kHz component of the signal, whereas the final stage of signal treatment is read at vo2.

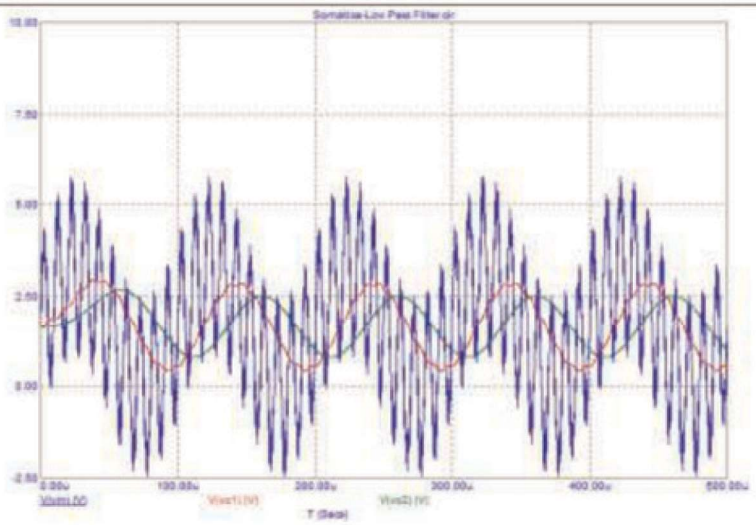
The signal can be plotted by reaching the analysis menu and go to the transient analysis:



Followed by the transient menu, where a suitable time to the used signal frequencies should be applied and also the simulating voltage points (V(vin), V(vo1),V(vo2)) should be added (can be typewritten (V(point) for voltage, I(point) for current:



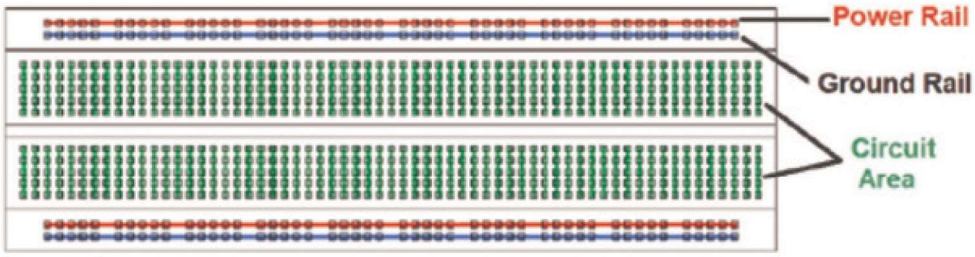
Always check X Expression as T for time. After pushing Run a graph like this should be outputted:



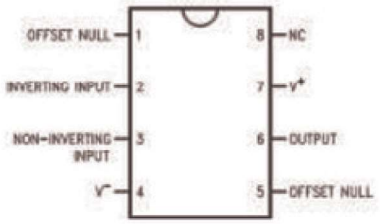
Where the green vo2 signal represents the final treated signal, without the noise contamination, where the information relies.

II. CIRCUIT CONSTRUCTION ON BREADBOARD

Giving the possibility for circuit mounting and probing with required equipment available, students should use a breadboard and respective components to connect with a breadboard such as the one below:



Wires should be avoided by trying to place components common electrical points, in the same connection area, such as the green zone (column by column). Further, the amplifiers powering DC lines (+15V, - 15V, Ground). The ground should be shared also with the signal generator, which will inject the signal in the input line of the circuit (vin - no more than 10V peak to peak of sinusoidal signal). In order to mount the circuit properly, the LM741 datasheet pinout connections should be followed.



III. PCB Design in KiCAD software

As extra work, in order to provide students with a complete and more definitive circuitry construction, a PCB design of the circuit they mounted, could be achieved by

an open-source software. Thus, if moving forward for this step, please refer to KiCAD tutorial file, and change circuit accordingly.

IV. Report

As final report, students should have a working circuit which filters conveniently by attenuating amplitude level of unwanted frequencies. And with the circuit input and output connected to a probing oscilloscope, students should collect data regarding Vin_{rms} of both having 5V peak to peak input signal for each frequency (1, 10, 100, 1000, 10000, 100000 and 1000000 Hz) at a time and measure circuit output voltage Vo_{rms} at each input. With the data, they should draw a circuit response in V/Hz for their report, which will increase understanding of how a tuned filter can be designed to pass only the desired signal frequencies and reject the unwanted ones. Furthermore, students should seek information regarding different filter types such as between passive filtering method and active filtering method.

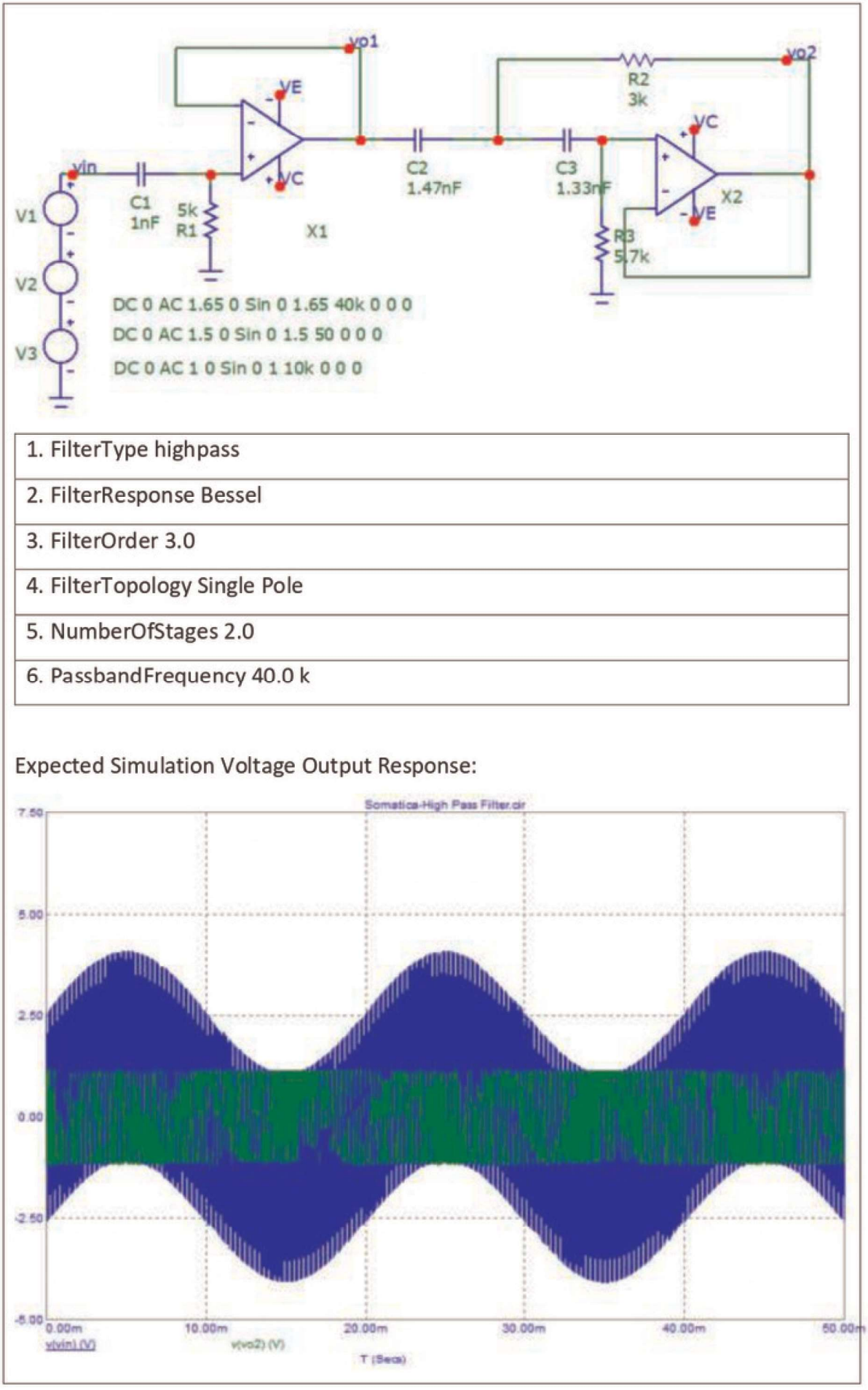
V. OTHER POSSIBILITIES

The general problem may be replicated by using several circuit approaches, for other cut-off frequencies, or other filter-types such as active high pass and band-pass. Following the same process as the first circuit (resistors and capacitors values should be as close as possible to reach a similar end result).

Many filtering topologies can be constructed by requirements, using a workbench at https://webench.ti.com/filter-design-tool/filter-type

Here are some examples which could be instructed to students:

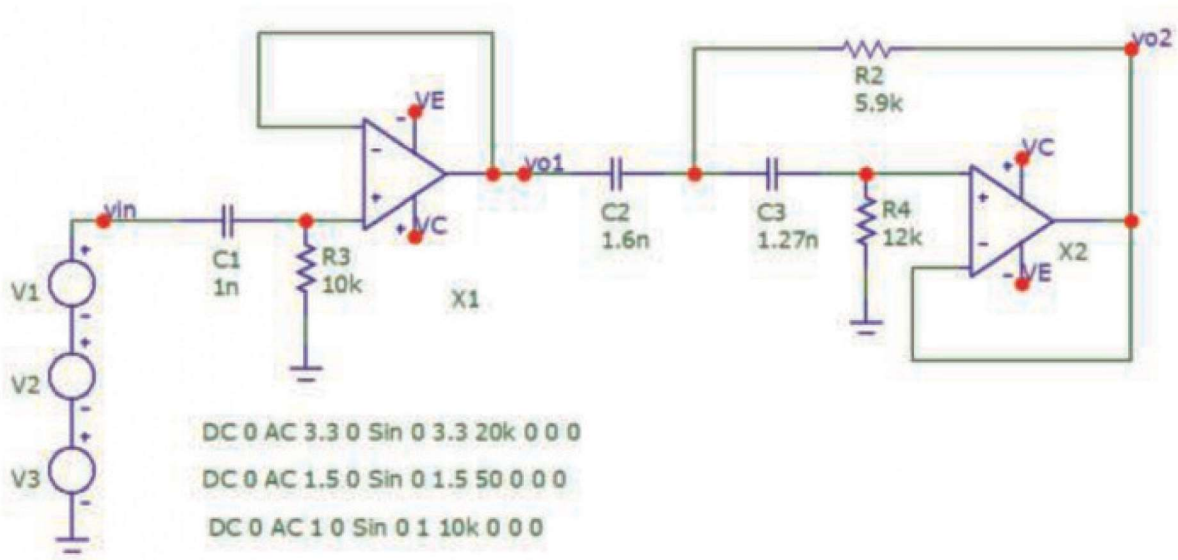
1. Active Filter High Pass 40kHz cut-off frequency (Highpass Filter - 3rd order Bessel):



1. FilterType highpass
2. FilterResponse Bessel
3. FilterOrder 3.0
4. FilterTopology Single Pole
5. NumberOfStages 2.0
6. PassbandFrequency 40.0 k

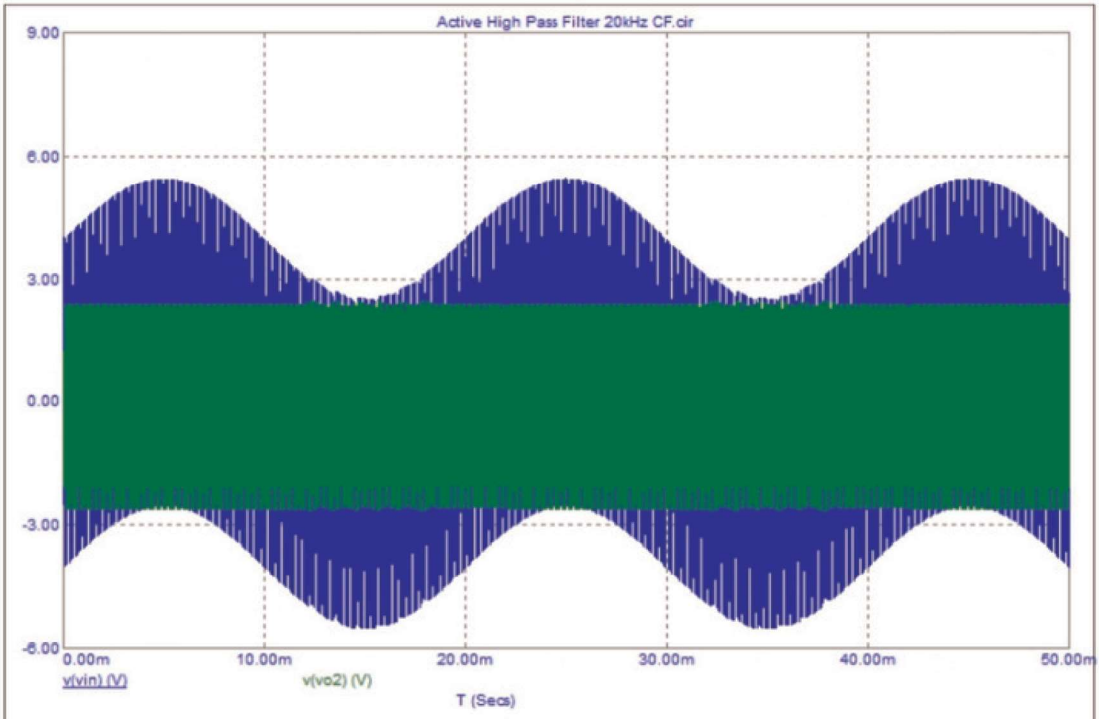
Expected Simulation Voltage Output Response:

2. Active Filter High Pass 20kHz cut-off frequency (Highpass Filter - 3rd order Bessel):

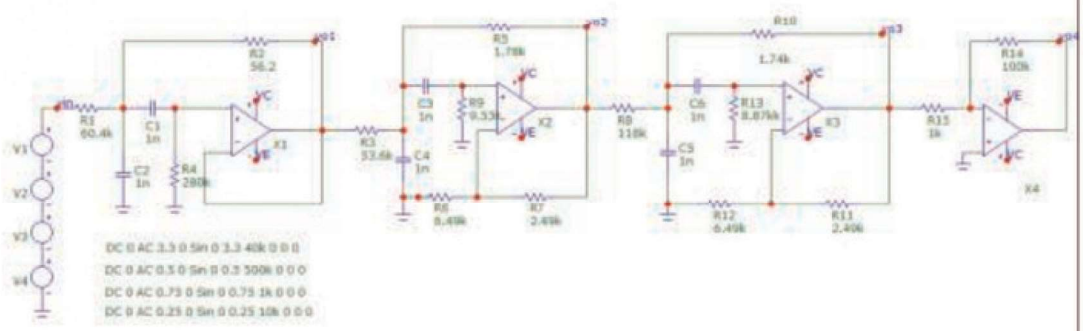


1. FilterType highpass
2. FilterResponse Bessel
3. FilterOrder 3.0
4. FilterTopology Single Pole
5. NumberOfStages 2.0
6. PassbandFrequency 20.0 k

Expected Simulation Voltage Output Response:

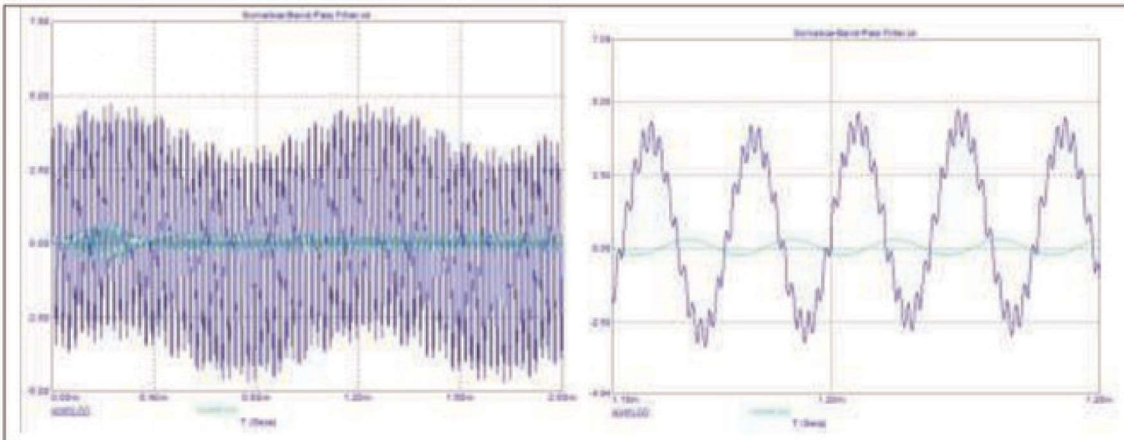


3. Active Filter Band Pass center frequency 40kHz and pass-bandwidth 2kHz (Bandpass Filter - 6th order Bessel):



1. FilterType bandpass
2. FilterResponse Bessel
3. FilterOrder 6.0
4. FilterTopology Sallen-Key
5. NumberOfStages 3.0
6. CenterFrequency 40.0 k

Expected Simulation Voltage Output Response:



H. Necessary equipment.

- A computer by group;
- Simulator Software Micro-Cap 12 installed (https://archive.org/details/mc12cd_202110);
- PCB Software KiKad installed (https://www.kicad.org/download/);
- Breadboard with unifilar wires KIT by group;
- Through hole Resistors and Capacitors library;
- LM741 with DIP package (https://pt.mouser.com/ProductDetail/Texas-Instruments/LM741CN-NOPB?qs=QbsRYf82W3Gt6%252BDX6%252BuAjw%3D%3D);
- At least one oscilloscope with probes (to be used by each group at a time, better one by group);
- At least one signal generator (to be used by each group at a time, better one by group);
- At least one bipolar DC current source +-15V (to be used by each group at a time, better one by group);

I. Form of relationship of the classroom with the tutor in the company: Frequency of meetings. Presentation of the progress of the project. Duration and agenda of meetings.

The meetings between the company tutor and the classroom teacher will not be scheduled previously. A continuous channel of communication will exist through the TECHVETLAB application, in order to solve any problem that may occur in the shortest

time as possible. This also applies to students, where they can use the TECHVETLAB app to contact the tutor of the company.

A videoconference will be made between the company tutor and the classroom every 15 days. In these meetings, a student from each team will present the progress of their team in the project. After this presentation there will be a debate with the company tutor where all the teams will be able to ask any questions that have arisen during the development of their project.

J. Format of presentation of the final results and conclusions of the work carried out in the classroom to the company.

The final report of the project will be presented in a single file, in a PDF format, with the following content structure:

1. Summary of the project carried out (half page maximum)
2. Introduction to the problem and respective applications of filtering techniques in electrical signals. Why is electrical signal noise contamination a problem? What are the consequences? What methods are used to mitigate it?
3. Studied filtering design solution and information found online summary. Simulation curve results for tested frequencies and respective voltage stages (vin, vo1, vo2... von).
4. MicroCap-12 Simulation Files (*.cir).
5. PCB design files ((project file)*.pro, (PCB design File)*.kicad_pcb and (Schematic Design file)*.sch).
6. Excel built graph from voltage peak to peak data obtained from practical results and respective comparison with simulation. (Should be used same Vin values and frequencies, change simulation voltage sources, R and C values as required in order to compare).

K. Initial information that the company can give to students about the proposed project.

Include pages as necessary

PART 2.- Detailed work plan We propose the work in the classroom to be carried out by 5 teams (can be increased by using more circuit arrangements), thinking of a classroom of 20 to 25 students. It can be rearranged to fit a smaller or larger number of teams.		
PHASE 1. Preparation		
Task 1.1. Search for information on Micro-Cap 12 simulation spice tool and familiarize with interface.	**Team:**	**Duration:** Week 1
Task 1.2. Search for information on breadboard circuit construction, capacitors polarity or non-polarity, resistors values color codes, common electrical points, LM741 datasheet analysis, DC power source, signal generator and oscilloscope manipulation.	**Team:**	**Duration:** Week 1
Task 1.3. Search for information on KiCAD design tool and familiarize with interface.	**Team:**	**Duration:** Week 1
Task 1.4. Micro-cap and KiCAD installation.	**Team:**	**Duration:** Week 1
PHASE 2. Design and construction		
Task 2.1. Circuit design and simulation on Micro-Cap 12.	**Team:**	**Duration:** Week 2
Task 2.2. Filter Circuit Construction on Breadboard.	**Team:**	**Duration:** Week 3-4
Task 2.3.	**Team:**	**Duration:**

Filter analysis by application of variable AC voltage levels and frequencies on input, by reading the output with an oscilloscope.		Week 4-5
Task 2.4. Peak-to-Peak Voltage data cataloguing for graphs construction on final report and simulation results intersection.	**Team:**	**Duration:** Week 4-5
Task 2.5. KiCAD design of a PCB of their assigned filtering circuit with BNC connectors for input and output.	**Team:**	**Duration:** Week 6-7
PHASE 3. Conclusions. Final Report		
Task 3.1. Final report writing.	**Team:**	**Duration:** Week 8
Task 3.2. Simulation and PCB design files, as well as mounted Breadboard circuits constructed and functional confirmation.	**Team:**	**Duration:** Week 8
Task 3.3. Oral presentation preparation of final project.	**Team:**	**Duration:** Week 8

Management software

For the management of the project, the educational management software "TECHVETLAB" has been created within the framework of the Erasmus Plus project "TECHVETLAB: A SOLUTION FOR THE POST-COVID-19 LABOUR MARKET THROUGH A TECHNICAL TRAINING OF VET STUDENTS WITH OBSTACLES" by experts from technology companies and vocational training educational centers with the aim of coordinating teamwork between the classroom and the company, as well as teaching students the methods and tools of business management and time control, developing transversal skills and establishing logical analyses.

TECHVETLAB is a completely free and innovative software compatible with that used by technology companies to control operational and production processes, but directly adapted to the characteristics and educational needs of VET students.
Through an intuitive design, this software allows you to create an online project in which the technicians of a company, the teacher of a classroom and the students of the same will work as a team and coordinate their work.

Free software for the project development

- Micro-Cap 12

Micro-Cap is an integrated schematic editor and circuit simulator that provides an interactive design and simulation environment for electronics engineers, and is compatible with SPICE (Integrated Circuit Emphasis Simulation Program).

- KiCAD

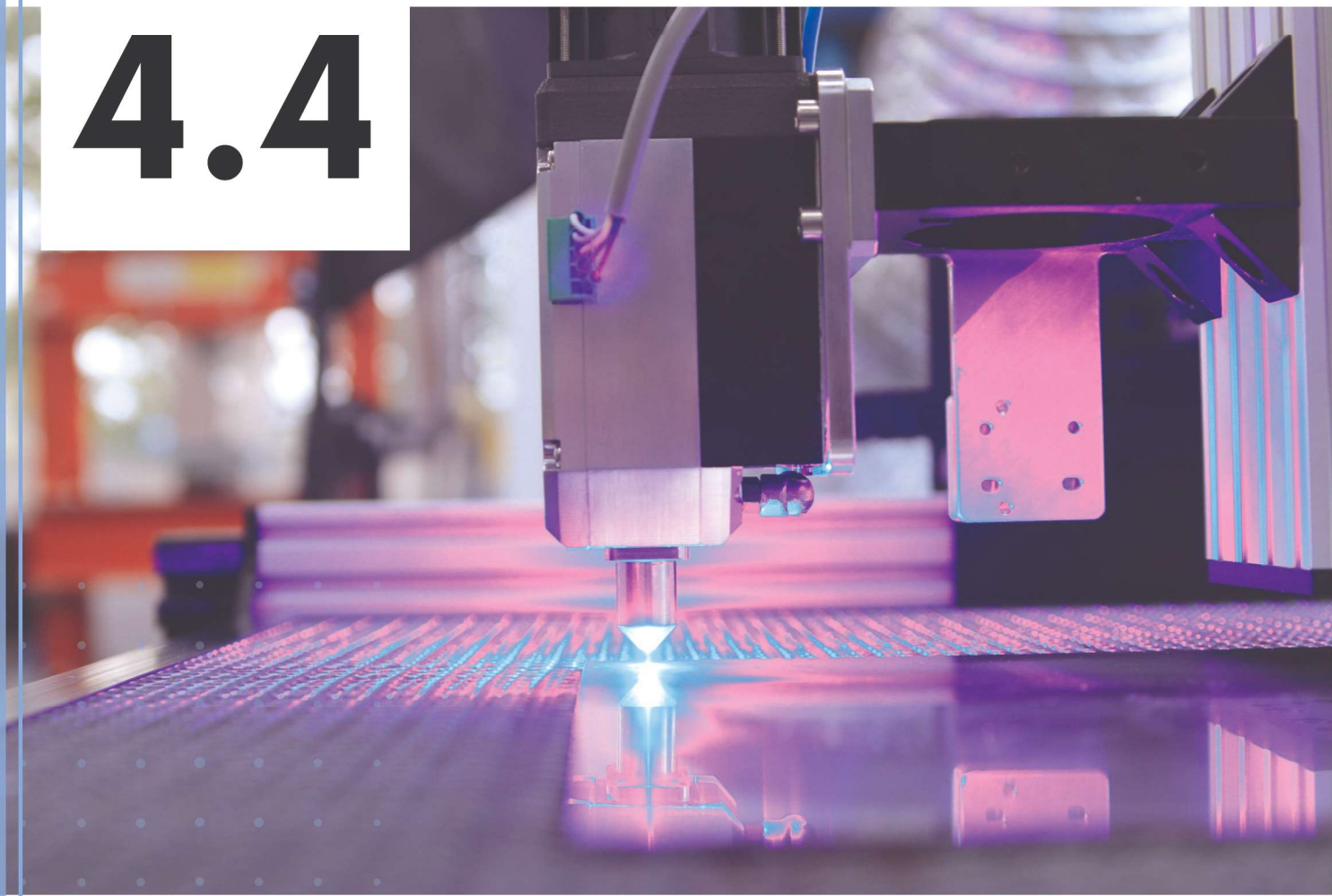
KiCad is an open-source software for automated electronic design (EDA) that features an integrated environment for schematic capture and PCB (printed circuit board) design.

IKASIA TECHNOLOGIES

WORK PLAN

IKASIA TECHNOLOGIES

4.4



BEING A PART OF IT

PART 1.- Project plan (to be completed by the company)

A. Title: Design of a bioreactor for cell culture	**B. Shared Folder/Server**	**C. Duration:** 2 months, 5 horas/semana

D. Brief description. Technical problem raised.

Cell culture is often performed in plastic well plates such as the one in Figure 1. The cells are seeded at the bottom of the well and covered with a liquid medium containing the nutrients they need. That culture medium is changed every few days. At Ikasia Technologies we are interested in developing a system that makes the culture medium flow continuously through the well and, in addition, that the cells are seeded in the pores of a sponge so that they have a three-dimensional environment. A preliminary development uses a syringe pump to propel the liquid and a silicone cap that tightly closes the well so that the circuit is closed. This project seeks the design of the complete equipment and its construction with an additive manufacturing machine.

Figure 1. Multiwell Cell Culture Plate

A preliminary design of the device is shown in the schematic in Figure 2.

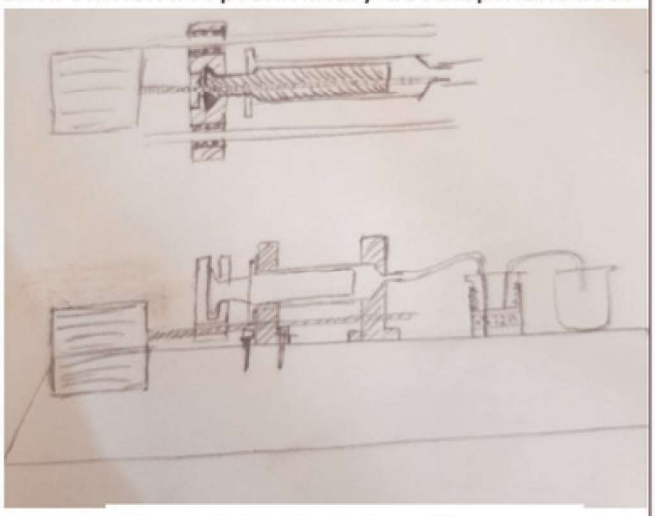


Figure 2. Device Schematic

E. Area or project of the company in which it is framed.

This work is part of the areas of project development and new materials of Ikasia Technologies.

Ikasia Technologies is a technology company created in 2015 as a spin-off of the Universitat Politècnica de València and promoted by the Centre for Biomaterials and Tissue Engineering. The aim of Ikasia is to contribute to knowledge and collaborate with the social and technological development of our society, thus contributing to a better future. For this

reason, it not only carries out a constant process of research and development, but, through the coordination and participation in projects of the Erasmus Plus Programme, promotes the inclusion of people with fewer opportunities, especially VET students with obstacles.

In this sense, the entity has 3 main areas of work: 1. Development of educational projects. Through educational projects in the field of vocational and adult training, it seeks to generate resources that encourage critical and scientific analysis to promote the inclusion and employability of students with obstacles in the technology sector, since they consider that the technological field can provide them with an opportunity. for employability and essential inclusion. Thus, in the last seven years he has coordinated and participated in seven projects of the Erasmus Plus Programme in collaboration with technology companies in Italy and Portugal and educational centers in France, Greece and Spain. 2. 3D printing. Ikasia has a 3D laboratory in which it develops hybrid materials with plastic, glass or ceramic components using a 3D additive manufacturing process patented by the entity. 3. 3D biotechnology. We are leaders in additive manufacturing systems in the field of biomedicine for the development of disease models and tissue regeneration. To do this, we create innovative 3D equipment that allows the creation of personalized and biodegradable models for each patient. Our goal is to contribute to improving the quality of life by creating effective personalized treatments without adverse effects for the patient.

F. General objective of the internship and possibilities to go further: How far are students expected to go in solving the problem posed?

General Objective: Design and construction of a perfusion bioreactor adapted to cell culture in a p24 plate, in porous sponges of a biodegradable polymer. The essential features of the equipment will be:

- Culture medium drive pump with a 100ml syringe.
- Medium flow rate: 0.05 ml/min.
- Design adapted to the manufacture of the entire assembly by 3D printing of fused filament and commercially available metal parts.
- Pump drive using Arduino.

The company will provide a culture plate and a sample syringe so that the precise dimensions can be taken.

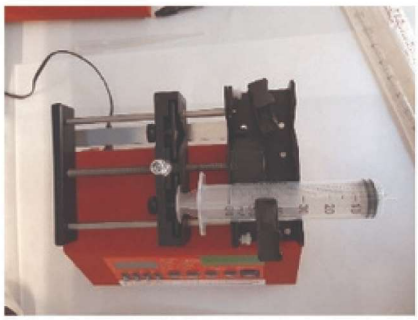
Additional objectives.

1. The design can be extended to be used as a three-dimensional support instead of a sponge, a filling of microspheres with diameters between 50 and 200 microns. To do this, a filter would have to be incorporated into the output to prevent the microspheres from being lost.
2. The simple design that has been proposed has limited operating time by the capacity of the syringe. It is important to complete the system with a device to refill the syringe from a larger volume bottle. It is necessary that the recharging process is carried out without disassembling it from the equipment, using a set of keys and the reverse gear of the plunger.

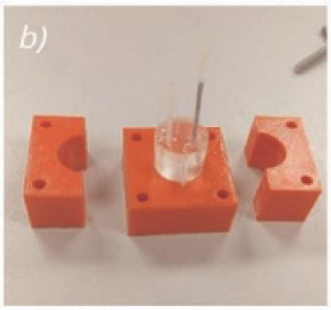
G. Specific Objectives. How can the general problem be broken down into several more specific problems that the teacher in the classroom can assign to different sub-working groups?

Specific Objectives:

1. **Syringe pump**. Syringe pumps can be found commercially. The system is really simple and we are interested in manufacturing it so that we can integrate it into our equipment. The body of the syringe is fixed horizontally on a support that must have a certain weight for the assembly to be stable. The plunger is attached on a sliding platform containing a fixed nut, as seen in the photos. A worm screw, threaded into the nut, is driven by a stepper motor. When the screw is turned, the plunger moves forward or backward, pushing the liquid in the syringe. Steel rods and thrust bearings shall be used for the displacement of the plunger.



2. **Stepper motor drive using Arduino.** Circuit and control program. The stepper motor receives instructions from an Arduino microcontroller (free hardware and software). The objective of the project is to assemble the circuit, with its power supply and to write the program that allows the motor to rotate at different speeds in one direction and in the other and to stop when the plunger of the syringe reaches the end of its travel.
3. **Design of the plug that closes the well.** The cap will be made of silicone. It will be crossed by two tubes of 1mm in diameter, the inlet will reach the bottom of the well, while the outlet will be flush with the plug. Thus, the culture medium enters through the bottom of the well, passes through the sponge containing the cells, and exits through the top.



4. **Mold to make the silicone plug that closes the culture well**. The mold will be made up of several parts that ensure that the demoulding is carried out easily and without damaging the part. Once assembled, it is filled with silicone, which is a two-component product that is mixed immediately before

being inserted into the mold and solidifies inside. Then the mould must be dismantled to remove the piece. The parts will be manufactured by 3D printing and joined together using screws.

5. **Selection of the material for the cap and curing protocol**. There are a multitude of low-cost commercial silicones out there. The one deemed most convenient will be selected. Using any mould, of similar dimensions to those of the cap that we are going to manufacture, the necessary tests will be carried out to establish the protocol that allows the part to be made without bubbles inside and to determine to what extent the dimensions of the manufactured part coincide with the intended one. It must be checked that the cap fits perfectly in the well and that it resists the internal pressure that will be created by the flow of the liquid medium.
6. **Assembly and calibration**. Once the equipment has been assembled, the set-up will be carried out, checking the operation and calibrating the flow of medium that circulates through the well according to the rotation speed of the motor. The tightness of the circuit will also be checked. The reproducibility of the operation should be checked after assembling and disassembling the cap, tubes and syringe.

H. Necessary Equipment. Can the company lend small pieces of equipment or bear the costs of acquiring them?

1. Fused filament 3D printing machine.
2. Printing material.
3. Computers with the capacity to load 3D design software, and generate GCODE print files.
4. Stepper motor. Threaded rod fasteners.
5. 2 x 6 mm diameter steel rods, one metric threaded rod 6. M6 Nut
6. 2 x 6mm diameter rod thrust bearings.
7. Arduino, power supply,
8. Liquid silicone of components.
9. Silicone tubes. Tubes that go through the plug.

10. Screws and nuts of the dimensions according to the design.

Ikasia Technologies and the Institute where the internship takes place will see how to make these materials available when they are needed for the development of the project. If the school does not have a 3D printing machine, the parts will be printed at the company's facilities.

I. Form of relationship between the classroom and the tutor in the company: Frequency of meetings. Presentation of the progress of the project. Duration and agenda of meetings.

The meetings between the company's tutor and the classroom teacher will not be scheduled, a continuous communication channel will be opened, through the TECHVETLAB application adapted to the time available by both of them. In this way, it is expected to resolve any doubts or problems that arise in the shortest possible time. Any doubts that may arise for students can also be consulted through TECHVETLAB with the company's tutor.

There must be a telematic meeting of the tutor with the classroom every 15 days. In these meetings, one student from each team will present the progress of the tasks assigned to their team in the project. After that presentation there will be a discussion with the tutor of the company and the whole team will be able to ask the tutor any doubts that have arisen or the problems they encounter.

J. Format for presenting the final results and conclusions of the work carried out in the classroom to the company.

The final report of the project will be presented in a single file in pdf format following approximately the following content outline

1. Summary of the project carried out on half a page.
2. Introduction to the problem. Bioreactors for cell culture. Similar equipment that is commercially available.
3. Studied design solutions. Solution chosen. Overall Schematic
4. The 3D file and the GCODE file of each part will be included.

5. Automatic drive and control system.
6. Assembly and quality control testing.
7. The complete equipment will be physically delivered to the company at the end of the project to be tested in their workshops.

K. Initial information that the company can give to students about the proposed project.

Include the pages you need

PART 2.- Detailed Work Plan We propose the work in the classroom to be carried out by 5 teams, thinking of a classroom of 20 to 25 students. It can be rearranged to fit a smaller or larger number of teams.		
PHASE 1. Preparation		
Task 1.1. Search for information about 3D printing. Selection of the printing material.	**Team:**	**Duration:** Week 1
Task 1.2. Search for information about Stepper Motor and Arduino. Installation tutorials.	**Team:**	**Duration:** Week 1
Task 1.3. Search for information on two-component silicones. Decision on the material to be used. Order.	**Team:**	**Duration:** Week 1
Task 1.4. Installation of 3D design software and generation of GCODE print files	**Team:**	**Duration:** Week 1
PHASE 2. Design & Construction		
Task 2.1. Syringe pump: Exploded. Design of each part in the 3D design program.	**Team:**	**Duration:** Weeks 2 to 5
Task 2.2. Generation of GCODE files. Printing settings.	**Team:**	**Duration:** Weeks 4 & 5
Task 2.3. Check before printing that there are no dimension errors.	**Team:**	**Duration:** Week 5
Task 2.4. Stopper mould: Exploded. Design of each part in the 3D design program.	**Team:**	**Duration:** Weeks 2 to 5
Task 2.5. Generation of GCODE files. Printing settings.	**Team:**	**Duration:** Weeks 4 & 5
Task 2.6. Check before printing that there are no dimension errors.	**Team:**	**Duration:** Week 5
Task 2.7. Assembling the Stepper Motor Control Circuit	**Team:**	**Duration:** Weeks 2 to 5
Task 2.8. Design of the anchors to the perforated base	**Team:**	**Duration:** Weeks 2 to 5

Task 2.9. Printing the parts	**Team:**	**Duration:** Week 6
Task 2.10. Manufacture of the cap	**Team:**	**Duration:** Weeks 6 & 7
Task 2.11. Assembly, calibration and fine-tuning.	**Team:**	**Duration:** Weeks 6 & 7
PHASE 3. Conclusions. Final Report		
Task 3.1. Drafting of the final report.	**Team:**	**Duration:** Week 8
Task 3.2. Verification of the final documentation deposited in the project folder: Final Report, 3D files of each piece, GCODE files.	**Team:**	**Duration:** Week 8
Task 3.3. Preparation of the final oral presentation of the project	**Team:**	**Duration:** Week 8

Management software

For the management of the project, the educational management software "TECHVETLAB" has been created within the framework of the Erasmus Plus project "TECHVETLAB: A SOLUTION FOR THE POST-COVID-19 LABOUR MARKET THROUGH A TECHNICAL TRAINING OF VET STUDENTS WITH OBSTACLES" by experts from technology companies and vocational training educational centers with the aim of coordinating teamwork between the classroom and the company, as well as teaching students the methods and tools of business management and time control, developing transversal skills and establishing logical analyses.

TECHVETLAB is a completely free and innovative software compatible with that used by technology companies to control operational and production processes, but directly adapted to the characteristics and educational needs of VET students. Through an intuitive design, this software allows you to create an online project in which the technicians of a company, the teacher of a classroom and the students of the same will work as a team and coordinate their work.

Free software for the project development

- FREECAD

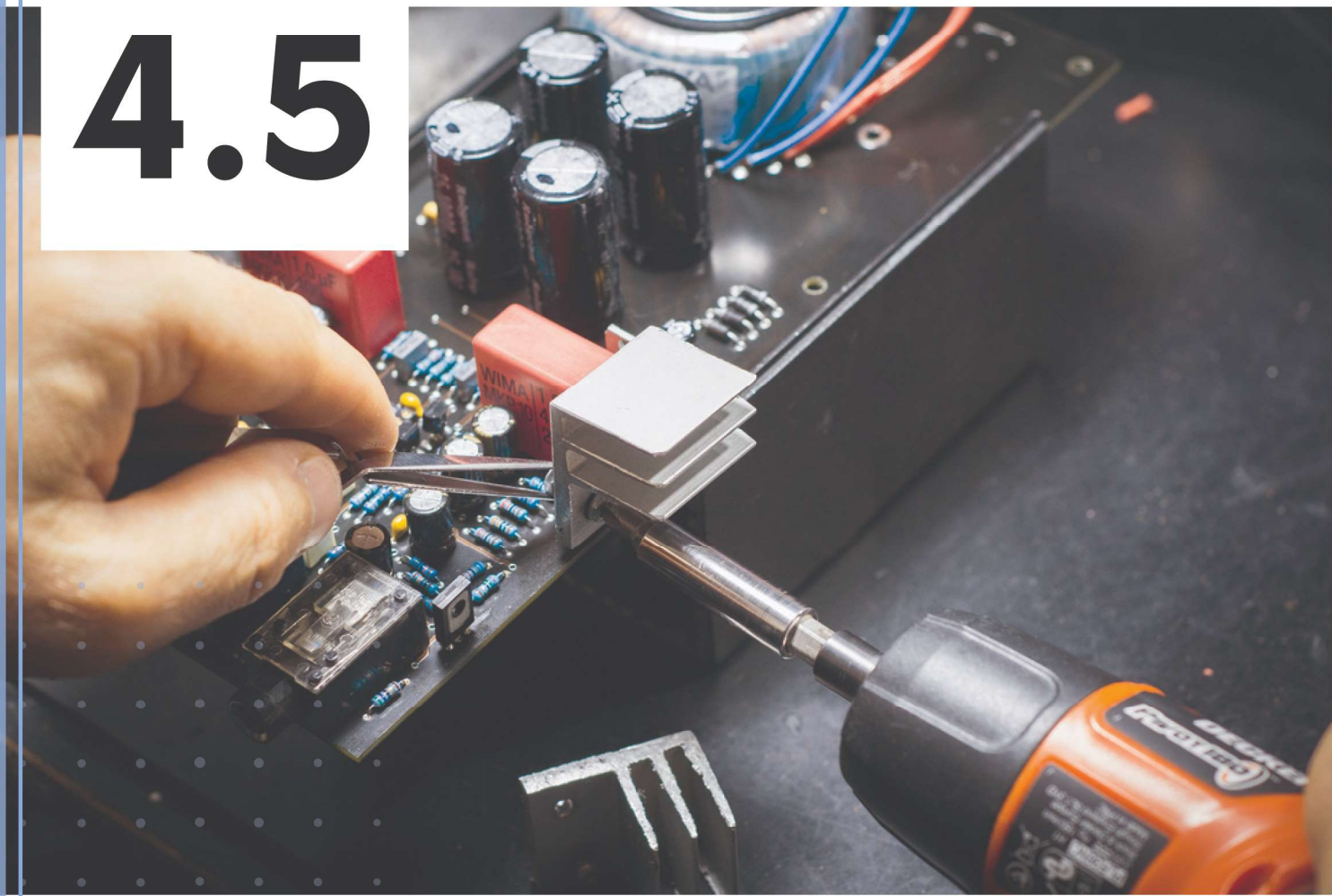
FreeCAD is a free and open-source 3D model design software that offers tools for producing, exporting, and editing full-precision solid models, exporting them for 3D printing or CNC machining, creating drawings and 2D views of your models, performing analysis such as finite feature analysis, or exporting model data such as quantities or bills of materials.

- ULTIMAKER CURA

Ultimaker cura is a free and open-source software designed for 3D printers, where you can modify the printing parameters to transform them into G-code and print 3D objects directly on a 3D printer.

WORK PLAN W4A

4.5



BEING A PART OF IT

PART 1.- Project approach (to be filled in by the company)		
A. Title: Design of a soil monitoring system for agriculture 4.0	**B. Shared/Server Folder**	**C. Duration:** 2 months 6 hours/week

D. Brief description. Technical problem raised.

The agroindustry sector corresponds to one of the primary sectors of the economy, due to the fact that it is essential to the socio-economic balance of societies, a sector that is heavily dependent on human labor and due to the complexity in detecting and evaluating the state and needs of the entire plantation development process.

It is in this context that the project proposal arises, which has as its general objective the development of a technology capable of detecting in real time the local needs of agricultural soil, and providing an immediate response to these same needs by providing only the nutrients and fertilizers necessary to the healthy and sustainable growth of plantations.

In this way, the solution (figure 1) makes use of the 4 technological pillars of the digital transition: Sensors, Intercommunication between devices, Aggregation and Cloud Computing.

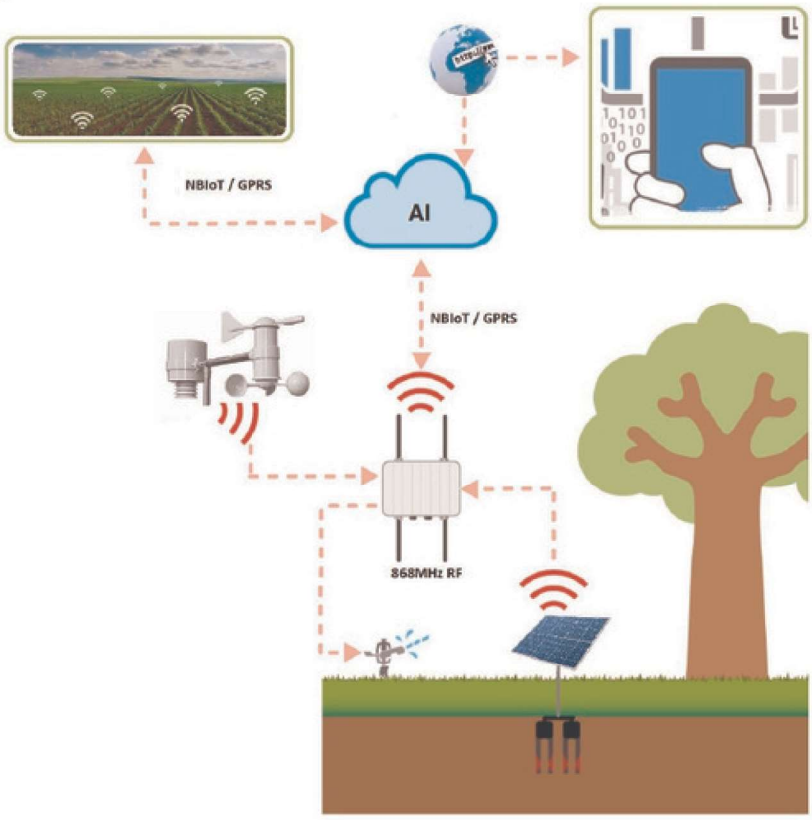


Figure 1: Shematic of the solution to be developed

Thus, W4A intends to develop a soil sensing platform with data communication to the cloud, for the future application of intelligent data analysis processes, which will guide the application of irrigation, fertilization and phytopharmaceuticals in agricultural plantations.

E. Area or project of the company in which it is framed.

This project focuses on the areas of product development, electronics in one of the areas of activity of W4A, ILDA .

W4A, IDA (W4A) is a young spin-off company from the University of Minho, founded in 2016, and focuses its activity on Research, Development and Production of customized solutions for industrial applications, IoT systems , signal acquisition and processing circuits and controllers. irrigation for agriculture, where it already has some solutions developed for several national and international clients.

Although young, W4A already has a permanent team of 5 people, 1 doctorate and 2 masters, and the rest dedicated to production, with sustained growth in its production level. W4A already has a vast set of equipment, suitable for the area of electronic development, providing a laboratory equipped for the development of instrumentation and measurement systems, development of network communication (wires and RF), as well as for prototyping electronic circuits.

It also has a wide range of additive prototyping equipment, which includes filament and UV 3D printers, a UV ink printer and a CNC machining center for prototypes.

F. General objective of the practice and possibilities to go further: How far are students expected to go in solving the problem posed?

In this project, the general objective is to develop new electronic signal conditioning and energy management systems for soil sensors. This system will have a wireless communication system, allowing the formation of sensor networks in RF and NBIoT , with the information being aggregated and structured in the Cloud in order to feed back the analysis and control system, an architecture that is illustrated in figure 1.

Additional objectives.

1. The development of the system can be extended by incorporating mesh data communication , which will allow the range of the receiving antennas to be increased.

2. The incorporation of an E- paper can be seen as an interesting solution to facilitate communication between the device and its operator

G. Specific objectives. How can the general problem be broken down into several more concrete problems that the classroom teacher can assign to different sub-working groups?

Specific objectives:

- **Soil sensor**

There are currently numerous soil sensors capable of improving the detection capacity of the main micronutrients that currently exist for the agricultural industry, based on different measurement topologies (figure 2). This aims to analyze the main advantages and disadvantages of each technology, with a view to selecting the most suitable one for the specific application.

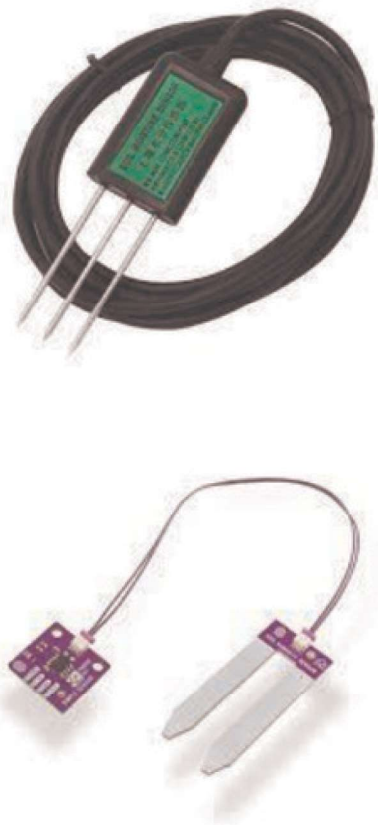


Figure 2 : Commercial soil mouth sensor examples

- **Electrical diagram of the MicroController electronic circuit**

There are countless electronic components on the market, with the possibility of being used in the scope of these works. Taking into account that the signal conditioning circuit is the key to the correct functioning of the media circuits, it is important to correctly analyze the circuits, evaluating how they interact with the selected sensor.

Also in the field of microcontrollers, there are countless possibilities, so to facilitate development, the platform used was defined, which is based on the EFR32BG22 microcontroller, figure 3:

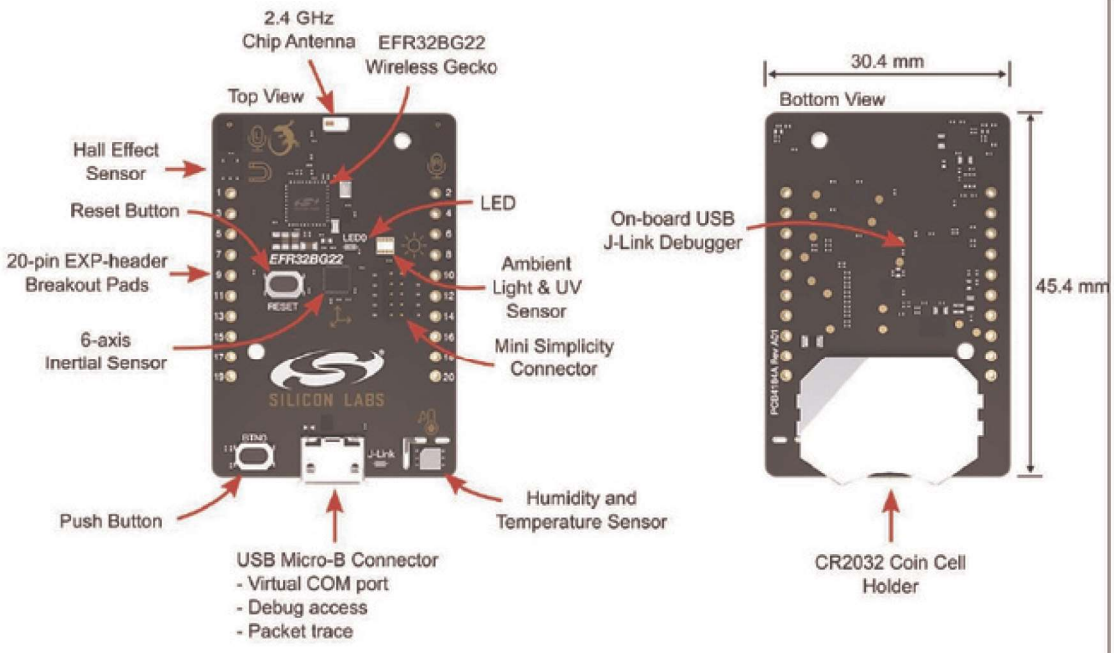


Figure 3 :EFR32BG22 Thumderboard

as it is a platform widely used by W4A, allowing for a much steeper development curve.

- **Electronic Circuit PCB Drawing**

The correct design of PCBs is a key step for the correct functioning of systems during operation. In this way, it is intended that all good practices are acquired and used in the layout and design of the PCB of this project.

On the other hand, during the layout process, it is important to take into account the manufacturing and assembly processes and limitations, for their correct implementation, so this is another point to be respected in the design of PCBs.

- **System Firmware Development**

It aims to develop the control firmware for the soil sensor reading system, as well as storing the collected data, until used to communicate with the system using the Bluetooth 5.2 protocol or higher.

Good programming practices must be implemented, with a view to reforming the robustness of the implemented code, as well as facilitating its analysis by third parties.

- **3D Drawing of the Box**

The aim is to study and design an appropriate soil monitoring system box, taking into account the additive manufacturing process to be used for its construction. Therefore, it is important to correctly model in 3D all the parts that make up the system, respecting their tolerances, as well as the tolerances of the manufacturing processes. The selection of suitable materials for the environmental conditions to which the system will be subjected is also a factor to take into account during the design process.

- **Prototype construction**

Once the various parts of the system have been built, it is important to assemble them in order to verify their correct functioning, taking into account the initial specifications. A real test will be carried out to evaluate the performance of the entire system, comparing the results obtained with results obtained by existing systems.

H. Necessary equipment.

1. commercial soil sensor
2. EFR32BG22 microcontroller development board thunderboard kit
3. Electronic components
4. PCB Design Software KiCAD (free)
5. Firmware Programming Software simplicity studio V5 or higher (free)
6. FreeCAD 3D design software (free)
7. 3D printing machine
8. Printing material

W4A and the institute where the practices are carried out will provide all the materials necessary for the development of the project in a timely manner. W4A also provides its production equipment for the production of both the PCBs and 3D components necessary to complete the project.
J. Format of presentation of the final results and conclusions of the work carried out in the classroom to the company. Company tutor meetings with the class teacher will not be scheduled if will open a cause for continuous communication, through the TECHVETLAB application adapted to the time available for one or the other. In this way, it is expected to resolve any questions or problems that arise in the shortest possible time. Any doubts that may arise, as well as students can also contact the course tutor via TECHVETLAB . the company, for any clarification A telematic meeting between the tutor and the class must be held every 15 days. In these meetings of one student from each team will present the progress of the tasks assigned to your equipment in the project. After this presentation, there will be a debate with the company's tutor and the entire team will be able to ask their particular questions according to the problems encountered.
K. Initial information that the company can give to students about the proposed project. *Include pages as necessary*

PART 2.- Detailed work plan We propose the work in the classroom to be carried out by 5 teams, thinking of a classroom of 20 to 25 students. It can be rearranged to fit a smaller or larger number of teams.		
PHASE 1. Preparation		
Task 1.1. Project analysis. **Description:** Definition of the action plan, according to the proposed distribution of tasks, according to the characteristics and skills of the group members	**Team:**	**Duration**: Week 1
Task 1.2. Software installation on individual computer **Description:** the installation of the software necessary for the execution of the project is very easy to do, just follow the steps indicated by the software itself. If doubts arise, the group members may ask each other how to obtain a solution to the problem encountered, or, as a last resort, they may search on the internet.	**Team:**	**Duration**: Week 1
Task 1.3. PCB design Software training **Description:** The software tool used for designing PCBs will be studied . Good practices and PCB design rules will be presented for correct design within the scope of this project.	**Team:**	**Duration**: Week 2
Task 1.4. Firmware development Software training. **Title:** Description: The software tool used to develop the firmware of the selected microcontroller will be studied.	**Team:**	**Duration**: Week 2

Good algorithmic and code structuring practices will be introduced.		
PHASE 2. Design and construction		
Task 2.1. Electronic components selection **Title:** **Description:** The necessary electronic components necessary for the correct operation of the soil sensor and BLE communication circuit will be specified. The same procedure is also required for the power circuit.	**Team:**	**Duration:** Week 2 to 3
Task 2.2. Circuit schematic design **Description:** After defining the components and circuit specifications, the next step involves designing the circuit in software. After designing the circuit, simulate it and verify that the output and response are the same as you need. You will probably spend a great deal of time in this step, fine-tuning the circuit according to the intended output signal. This step is iterative, that is, you may have to go back to the circuit diagram and adjust it to receive the desired output	**Team:**	**Duration:** Week 3 to 5
Task 2.3. PCB design and layout **Description:** After the hardware implementation has been successful, the next step will be to convert the circuit design to a printed circuit board (PCB). Most software automatically provides a PCB when designing the circuit schematic. Print the PCB design in a file so that you can order, in the future, the PCB production in W4A.	**Team:**	**Duration:** Week 6
Task 2.4. Control algorithm definition **Description:** The control and data communication algorithm to be implemented in the	**Team:**	**Duration:** Week 4

microcontroller will be defined . The protocol and sampling rate will be specified, taking into account the limitations imposed by the system.		
Task 2.5. Firmware implementation **Description:** According to the defined algorithm and PCB specifications , the firmware used on the identified platform will be implemented. At an initial stage, the development , as a way of allow the parallel development of tasks. Being migrated to the final system as soon as it is built.	**Team:**	**Duration:** Week 4 to 6
Task 2.6. Study and dimensioning of the box for the electronic system **Description:** The needs of the box will be defined in terms of its volume and constituents	**Team:**	**Duration:** **Week 3**
Task 2.7. Box design and modeling using 3D design software. **Title:** **Description:** The box will be modeled in 3D, considering the possibility of 3D printing.	**Team:**	**Duration:** **Week 4 to 5**
Task 2.8. 3D printing of the various constituent parts of the box for the system. **Description:** The code (G- code) will be generated for printing the various parts and their respective printing.	**Team:**	**Duration:** **Week 6**
Task 2.9. Assembly of the final prototype **Description:** All components of the system will be brought together and the final prototype will be assembled	**Team:**	**Duration:** **Week 6 to7**
Task 2.10. Functional test	**Team:**	**Duration:** **Week 6 to 7**

Description: A functional test of the system will be carried out, using a pot with a little soil, where water will be placed with and without fertilization.		
Task 2.11. Analysis of the obtained results **Description:** A critical analysis of the data collected in the previous task will be carried out, with a view to verifying the efficiency of the measurement system.	**Team:**	**Duration:** **Week 6 to 7**
PHASE 3. Conclusions. Final Report		
Task 3.1. Gathering and organizing documentation generated throughout the project. **Description:** In this task, all documentation generated throughout the project will be organized, enabling its subsequent analysis and/or reproduction.	**Team:**	**Duration:** **Week 8**
Task 3.2. Final report preparation **Description:** The final report will be prepared in accordance with the defined requirements.	**Team:**	**Duration:** **Week 8**
Task 3.3. Final video preparation **Description:** A video will be produced explaining the various steps of the development carried out as well as the results achieved both at the project level and at the training level.	**Team:**	**Duration:** **Week 8**

Management software

For the management of the project, the educational management software "TECHVETLAB" has been created within the framework of the Erasmus Plus project "TECHVETLAB: A SOLUTION FOR THE POST-COVID-19 LABOUR MARKET THROUGH A TECHNICAL TRAINING OF VET STUDENTS WITH OBSTACLES" by experts from technology companies and vocational training educational centers with the aim of coordinating teamwork between the classroom and the company, as well as teaching students the methods and tools of business management and time control, developing transversal skills and establishing logical analyses.

TECHVETLAB is a completely free and innovative software compatible with that used by technology companies to control operational and production processes, but directly adapted to the characteristics and educational needs of VET students. Through an intuitive design, this software allows you to create an online project in which the technicians of a company, the teacher of a classroom and the students of the same will work as a team and coordinate their work.

Free software for the project development

- KiCAD PCB Design Software
- Simplicity Studio V5 or higher firmware programming software
- FreeCAD 3D drafting software

05

PARTICIPATION IN RESEARCH PROJECTS

The BPI methodology is mainly focused on vocational training students, although its application is expected to have significant advantages for the school and for the companies participating in the project.

Perhaps the most important aspect of a student's participation in a research project proposed and tutored by a technology-based company is their motivating role in their studies and subsequent professional careers. A key feature that we consider to be the fact that this project is carried out at the beginning of vocational training education.

This makes the student see that their expectations for a professional career can go far beyond a routine job in a company. The fact of participating in a project of a technology company has to show you all the contribution of creativity and innovation that a professional career can have for your personal growth. It is clear that whether this experience is motivating depends to a large extent on the preparation of the projects that are proposed: that they are at the same time realistic and integrated into the company's lines of work and are within the reach of the students' creativity.

We could find ourselves with a project that sets objectives or activities that students who start their studies are not able to understand and throw in the towel from the beginning. On the contrary, you could fall into the other extreme, presenting students with projects that are actually fringe proposals or academic problems. You have to avoid both extremes.

The project must show the student the world of technological development and therefore it must show that the objective of the project is an innovative product and that the student himself, within a broad working group, has the capacity to contribute to that achievement. The examples of projects that we have included in this guide, we think, meet these characteristics. We hope that participation in the research project will generate a positive attitude towards the contents of vocational training studies.

On the other hand, we believe that it is very positive that the student begins their studies by participating in a job with objectives and activities that are difficult for them and make them value all those skills or tools that they will see throughout the work that are very useful or simply necessary to carry out the project and that at that time of their studies, Of course, it doesn't dominate.

We consider it a very valuable educational tool if the student needs knowledge or a skill and looks for a way to acquire it. Later we will see in more detail how the BIS methodology contributes in a very significant way to training in the key competences defined by the Council of the European Union of 2 May 2018 [Recommendation of the Council of the European Union of 22 May 2018 on key competences for lifelong learning. Official Journal of the European Union 4/6/2018].

The type of work to be carried out shows the need to master digital tools, both in communication and in the search for information, the organization of that information found, and if it is the case the calculations, design or operation of machinery

It should not be thought that a single activity in the vocational training will make the student acquire any of these key skills. The Council of Europe's own recommendation recognises that these are skills that will be acquired throughout basic training, with the contribution of different subjects and educational activities, as well as being intimately interconnected. However, the BPI methodology can motivate the student to acquire those competences and show them a way to do so.

Special emphasis is placed on skills related to linguistic, digital and multilingual communication. The project carried out by the students is immersed in a European network of technology companies and vocational training centres. Students will have to interact continuously with a foreign tutor to whom they will present their progress, they will consult their doubts and they will have to accept their criticism if it is the case. The fact that the project is carried out as a work that involves the whole classroom can show very well the essentials of the organization of work and the ability to communicate orally and in writing to let the other colleagues in the group know the results of the tasks that one performs and to critically analyze one's own work and that of others.

Competences related to mathematics and science, technology and engineering and entrepreneurship are directly related to our projects. We're going to work on how to address a problem. The need for critical thinking and the application of the scientific method must appear in order to ensure the effectiveness of the work in the direction of achieving a specific objective. Critical thinking tools and skills are key in training and careers. We propose critical thinking to students as the reflection on their own thinking, on the way in which they accept as valid their own or others' information or reasoning. These are skills that are learned throughout life and that our interest is to make clear at the beginning of vocational training the need to acquire them.

The need to acquire the competence to learn how to learn is shown when facing a project at the initial stage of vocational training, the student, the teachers and the tutor of the company must be aware that the knowledge and skills of the students are limited at this stage and that each step in the development of the project requires learning, It requires looking for information, making an effort to critically analyze it, organizing and understanding it, asking relevant questions and knowing how to ask them to those who can help solve them, and relying on others to move forward.

As we have seen in the preceding paragraphs, the aspects of motivation of the student for their studies are one of the keys of the BPI methodology and must be evaluated at the end of the project, trying to contrast whether this initial stage of training is effective with respect to the rest of the vocational training.

For the technology company, participating in the network of European companies and education centres is a way of expanding relationships and receiving a flow of ideas on methods of work organisation. Students' ability to contribute innovative and creative ideas in many aspects of design or manufacturing should by no means be underestimated. Projects are presented to students with the sincere intention of advancing product development.

Despite the fact that the BPI methodology is student-centred, as it could not be otherwise, the advantages for companies and educational centres of participating in these projects are not negligible

For the school, the research project should lead to an improvement in the attitude of the students throughout the rest of their studies, more interested in learning and with a better interaction with the teachers. It is also worth highlighting the benefits for the centre of participating in the network of technology companies and vocational training centres, with what this means in terms of the contribution of new ideas and participation in other exchange or training projects.

06

METHODOLOGY: WORK IN THE CLASSROOM

The technology project will engage students in a collective process of reflection and creation, allowing them to learn a structured and collective approach to analyzing, proposing, producing, and communicating.

Your success will depend on a combination of many factors: clear goals, rigorous planning, a committed team, effective resource management, regular monitoring, adaptability to change, partner and user satisfaction (if this can be measured later), and the production of appropriate documentation

The teacher working in relation to the company must consider all these factors, which may vary depending on the nature of the project and its specific objectives, in order to lead, guide and motivate the team formed by their students to achieve the best results. In fact, it is this teamwork that is essential for the project to run successfully while learning.

6.2.1. Parameters to be taken into account

The main parameters are linked to the nature of the technological project and the school context, with its requirements and habits in terms of schedules, assignment of subjects, evaluation and validation of skills.

The technological projects that can be carried out by a class have the following characteristics:

- Technology is at the heart of the project and plays a key role in achieving the goals, which may include software development, creation of electronic systems, hardware engineering, data analysis, integration of digital solutions, etc.
- A degree of technical complexity linked to the nature of the technologies used, requiring specialist knowledge, technical skills and a thorough understanding of the underlying technological concepts.
- They often involve cooperation between professionals from different disciplines. In this case, it is the students who will have to cover these different areas of specialization and coordinate their work under the guidance of the professor. If the goal of the project is to offer a solution to the market, the skills required will not only be scientific, technical, or IT-related, but may also involve fields such as marketing or sociology. Therefore, a multidisciplinary approach is essential to solve the problems that will arise and create effective technological solutions.
- Your progress may be subject to a number of specific technical risks, such as hardware failures, programming errors, security vulnerabilities, compatibility issues, etc. Planning and regulating teamwork should allow these risks to be assessed in advance so that they can be managed to minimize potential problems.
- The projects will include an exploratory dimension for students, linked to innovation and research processes. Teamwork will facilitate the attitudes necessary for this process: a creative approach and critical thinking to propose innovative solutions.
- Technology projects are unlikely to be limited to a single phase carried out entirely within the classroom.

Therefore, these specific characteristics must be taken into account in the time and place of the school, which in turn have special characteristics that the company will need to integrate in order for the project to be successful. In fact, although the company will benefit from the work, skills development and enthusiasm of the young people, all supported by the scientific, technical and teaching skills of the teacher, the fact is that this is work carried out in the course of training, in a school environment and not by a subcontractor company. The consequences in terms of communication, production process and expectations will have to be taken into account by the partner companies.

CHARACTERISTICS INFLUENCING THE PLANNING AND MANAGEMENT OF WORK IN THE CLASSROOM

Depending on the size of the class, the number of students involved in the project may be limited, two projects may be developed, or perhaps, preferably, the same project may be dealt with in parallel by two half-classes.

The choice of the teacher to lead the project team or tutor. How much time will they be able to devote to it and at what pace? In addition to facilitating the teamwork of their students, they will also have to facilitate the teamwork of the teachers who may have a role to play in the smooth running of the project.

Available hardware resources. Although technological education institutions generally have all the computer and physical resources at least equivalent to SMEs in the specialisations concerned, access by students at all times is not widespread. Therefore, teamwork planning will need to take into account the potential limitations of competitive access to hardware (having tried, of course, to keep them to a minimum).

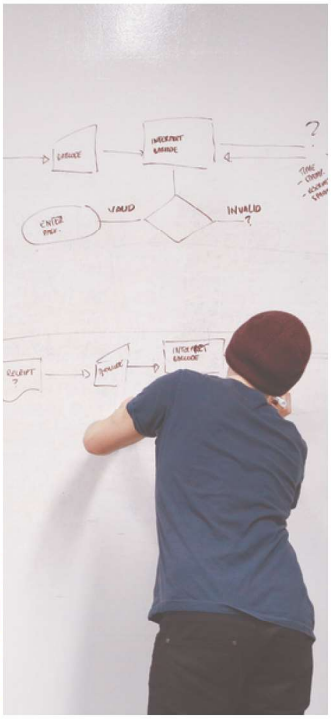
The weekly time spent on the project. As school teaching is still largely organized by subjects, this time is linked to the way different teachers (and subjects) will work together: full weeks, full days, half days, a few hours spread throughout the week. The pace of work chosen or made possible by the wishes of the teaching team and the school management will influence the organisation of teamwork.

The relationship of the project with the exam or diploma: what competences should it allow to be assessed? Will they be evaluated inter- or cross-sectionally? How will the company participate in the evaluation process?

The participation of different teachers. For example, if a math concept that hasn't been studied yet turns out to be necessary for the project, the math teacher may have to be involved, which wasn't necessarily planned.

The existence of school holidays

All of these factors will influence the planning and progress of teamwork. Finally, involving students in this choice of project, organizing one or more brainstorming sessions where they can come up with ideas and voting for the one that interests them the most will optimize the quality of subsequent teamwork. To reinforce this sense of ownership, it's also a good idea for students to canvass companies ahead of time, looking for potentially feasible projects.



DISTRIBUTION OF FUNCTIONS

How the team is trained, prepared, and monitored will play a crucial role in the success of the project. As mentioned above, it is important to ensure that the team has the necessary knowledge and skills to carry out the required tasks, and that these are achievable. If necessary, an ex ante refresher course can be provided to complement the entry in itinere.

Roles within the team will be co-defined in advance, with functions and objectives specified for each student. Conventionally, the defined roles can be identified with those existing in a technology company: a project manager, a technical director, a design manager, a communication manager, developers, possibly if applicable, a budget management manager, a quality manager to carry out tests, detect errors and ensure the quality of the technological solution developed, etc. A student will be responsible for coordinating project documentation, reminding everyone of the need to contribute. A student will be responsible for coordinating project documentation, reminding everyone of the need to contribute regularly. Time management can also be entrusted to a student.

However, there is a risk in designating roles in this way, i.e. conferring a "title" within the project. While this may motivate students by giving them an element of recognition, designating a responsibility can limit cooperation and creativity by locking students into predetermined roles (which would prevent another student from expressing their skills, which they themselves may discover in the course of the project, in a task for which they were not considered a priori and,therefore, designated as an essential contributor), or even reproducing a functional hierarchy that could be detrimental to the achievement of objectives because it limits the necessary agility. It is also important to avoid attributing a priori recognition that reproduces the school's scale of values (the best student project manager or the least good person in charge of project documentation).

Therefore, the teacher, in consultation with the students, is free to use his or her imagination to determine roles that are not exclusive and that do not lock students into situations of domination or dependence.

If the class is divided into subgroups, each should bring together students with technical, design, and communication skills, etc., but also with complementary interests and personalities. Heterogeneous and diverse groups will foster cooperation, mutual learning, and creativity to solve problems more effectively. Attention to the fact that students should be able to learn from each other will be one of the guiding principles in the constitution of groups.

It is also advisable to choose a contact person who will be the only point of contact with the company.

Organization of work in the classroom

The teaching objectives of the project

In this section, we return to the teaching objectives that we have already talked about in relation to the preparation of the project by the company.As we said there, the teaching objectives of these internships have less impact on the content and more on the development of certain transversal skills that we believe are essential for the development of a professional career in technology companies and linked to innovation, many of these competences are related to critical thinking skills applied to science and technology. Below, we briefly analyze how the methodology we propose contributes to the development of some of these competences:

- **Setting objectives**. It is suggested to divide the group, if it is large, into several teams to which certain specific objectives will be assigned. Each team will need to pinpoint those goals and plan their work to achieve them.

- **Responsibility, achievement of objectives.** The project as a whole is going to be posed as a challenge to the classroom. Students should be made to see that successfully developing such a project as a group is an important achievement for each of those who participate in it and at the same time that success requires the contribution of all those who make up the group.

- **Group work skills**. Effective work in each of the teams that is formed does not come naturally. You need to understand and internalize certain organizational strategies and many social, communication, and personal interaction skills.

- **Effective oral and written communication**. All students must participate in the oral presentation of results and progress reports throughout the development of the practice. They must do this both in group meetings and in front of the company's tutor. These presentations should be rehearsed, use appropriate means, and be subject to comments and suggestions for improvement. On the other hand, the evaluation of each student will be based on their writing of the workbook that we will see later, in which they will be asked to reflect on their contribution to the work of the team, the analysis of the results obtained and the critical view of the progress of the project.

- **Use of ICT tools**. Much of the work that can be done in the classroom will have to do with the use of management software packages and computer-aided design, simulators and automatic control systems, three-dimensional printing, teleworking tools, etc.

- **Autonomous learning.** We will dedicate an important part of the practice to the critical search for information about the concepts and tools necessary for the realization of the project, the organization of that information, and its understanding.

- **Intellectual honesty.** We are referring to honesty when judging one's own thinking, the way one has made a certain decision or accepted a piece of information or message. Also to self-criticism for the work done.

Work teams

The teacher can initially consider how to organize the work teams, how many students in each team, if it is the teacher himself who assigns each student the team to which he or she will belong or if the students are allowed to organize themselves. In view of the specific project objectives defined by the company, the number of teams and the tasks assigned to each of them will be planned.

Teamwork orientation

Some guidelines can be proposed on the organization of work in the classroom. For example, every day a student from the team leads the work meeting, an agenda is established, time is dedicated to presenting the results of the work done in the previous session, the activities to be carried out in that session are proposed, minutes are written with a succinct summary of the decisions. These initial meetings should be very short, it is essential that as much time as possible is devoted to actual work.

Concepts and tools that the teacher believes students should learn in the initial phase of the project

It is the teacher who can best define this essential part of the work. Perhaps he can explain something himself to the students of a certain team, but we are going to focus especially on the task and strategies to search for that information autonomously by the students. Despite this, students may initially need the teacher to guide them on what concepts will be necessary, for example, if they will need to understand how a stepper motor works, or how to calculate the intensity of current in an electrical circuit. It can also indicate whether they will need to learn how to use a spreadsheet or other particular calculation tool. Students may not notice these aspects at first and may lose too much time to focus on the problem at hand. The teacher's active stance will save a lot of time at this stage.

Follow-up

The initial schedule of the practice can include the frequency with which each team will present the progress of their work in classroom-wide meetings and the mechanisms of interaction between the teams, because obviously the work of some will depend on the results of others. Each student will fill out a workbook, in the form of a laboratory diary in which they will briefly write down their activity and critically analyze their results, those of their team and those of the entire group.

Evaluation

The evaluation of each of the students will be based on their workbooks and the oral presentations in which they participate.

Included below is a template that may be useful for this programming.

PART 3.- Organization of the work in the classroom (to be completed by the teacher)		
A. Title:	**B. Shared Folder/Server**	**C. Duration:**
D. Concepts and tools that students should learn in the first phase of the project. Documentation that can be provided by the teacher if applicable.		
E. Number of work teams and specific objectives of each of them.		
F. Evaluation Criteria.		
G. Notes on the evolution of classroom work throughout the project.		
Include the pages you need		

COMMUNICATION AND COORDINATION MECHANISMS WITH THE COMPANY

Coordination is key for a work team to work and be effective, achieving the objectives of a project and for it to be developed successfully. Currently, but especially in the wake of the COVID-19 pandemic, teamwork and virtual coordination are highly valued skills in the work environment of companies.

Thus, coordination is one of the basic elements that must be achieved between the company and the vocational training classroom in order not only to develop the objectives of the project, but also for students to acquire basic skills for their future employability in the technology sector.

6.1

The basic aspects for coordination between the company and the classroom are communication and management and planning:

- **Communication.** Fluid and stable communication is essential both for the proper development of a project and for teamwork. Fostering teamwork not only promotes the development of critical thinking, but also generates a spirit of learning and collaboration essential for working in multidisciplinary teams. In addition, good communication will allow you to get to know the team members, a key aspect to achieve good coordination between everyone.

- **Management and Planning.** The development of a detailed work plan that specifies all the tasks, objectives, phases and schedule of the project is essential for proper coordination, especially so that students can be clear about the work they are going to carry out and can work as a team successfully. It is very important that all team members are clear about what the short, medium and long-term goals are.

6.1.1. Management and planning mechanisms.

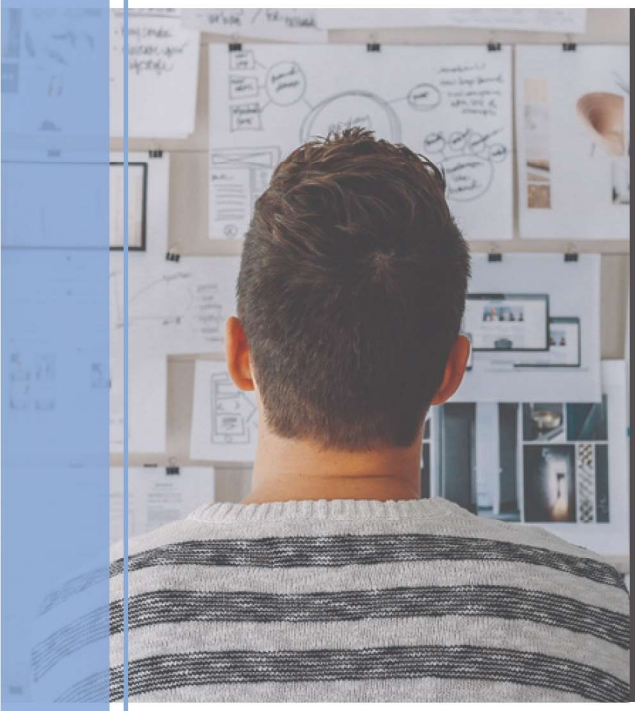
There are many tools and mechanisms for managing and planning a team. However, it is advisable to use tools that are free, simple, and intuitive so that students can learn easily. In this guide, we wanted to recommend the educational management software "TECHVETLAB". This has been created within the framework of the Erasmus Plus project "TECHVETLAB: A SOLUTION FOR POSTCOVID-19 LABORAL MARKET THROUGH A TECHNICAL TRAINING OF VET STUDENTS WITH OBSTACLES." by experts from technology companies and vocational training centres with the aim of coordinating teamwork between the classroom and the company, as well as teaching students the methods and tools of business management and time control, developing transversal skills and establishing logical analyses.

Techvetlab is a completely free and innovative software compatible with that used by technology companies to control operational and production processes, but directly adapted to the characteristics and educational needs of VET students.

Through an intuitive design, this software allows you to create an online project in which the technicians of a company, the teacher of a classroom and the students of the same will work as a team and coordinate their work.
Among the first functions available in this software are:

PROJECT MANAGEMENT

Project managers can manage, coordinate and monitor the entire project as a whole, having the possibility of accessing a global view of it. On the other hand, students, from the main panel of the project, can access the most relevant information of the project (description, objectives, tasks, distribution of the task, calendar...).

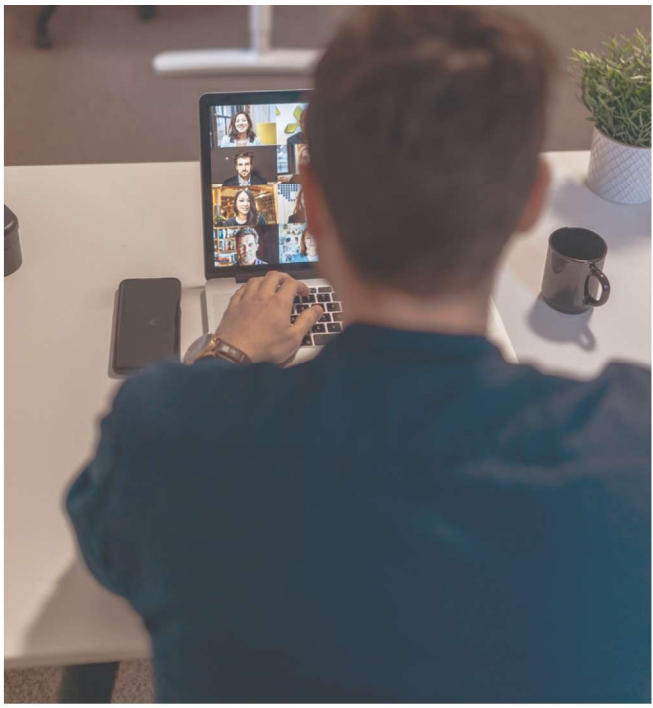


TASK MANAGEMENT

On the one hand, project managers have the ability to create and assign assignments to multiple students. On the other hand, the students have the main information of the assignments. In addition, by selecting a task, they access a detailed description of it and comments from the company's teachers and technicians to help them in its realization.

NETWORKING

The software has a "Networking" section that allows participants to collaborate and discuss any aspect related to the project. Good communication not only increases productivity, but also allows you to learn how to work in a team and develop key elements of critical thinking. In addition, it will improve the ability to work interdisciplinarily.



PLANNING

You can create Gantt charts, a tool that allows you to have a global view of the tasks and phases of a project. These diagrams allow students to be aware of the overall performance of the team, encouraging collaboration and work organization. In short, learning transversal skills from working in a company.

TIME MANAGEMENT

Using a calendar, users will be able to see planned meetings, task and phase completion dates...

STUDENTS MANAGEMENT

Managers can add users to the project team, assigning them a name, a role, a department, the branch of study and the school or company to which they belong. Students can access this information, allowing them to get to know each member of the team, especially the company's technicians with whom they will work side by side.

6.1.2. Communication mechanisms and tools.

These tools are key to virtual communication between the company and the classroom. The main tools that will be used are those that will allow both synchronous and asynchronous communication between team members.

A) Synchronous communication tools.

These are tools that allow real-time communication to be established between two or more users who are connected at the same time.
The main tools that will be used for synchronous communication between students and teachers and members of the technology company are videoconferencing and chat.

Video Conferencing
It is a tool that allows virtual meetings between team members. In this specific case, these meetings will be held between teachers, students and the company's staff involved. They are important both to maintain fluid communication between the classroom and the company and to deal with the most relevant aspects and monitor the project.

During these meetings, students will present the progress of their work so that it can be evaluated and analyzed by the technology company's technicians. In addition, these presentations will make it possible to resolve doubts, deal with problems that may have arisen and seek solutions, etc.

On the other hand, they will allow meetings to be held between the teacher and the person in charge of the project of the technology company, which will make it possible to specify relevant aspects of the work in the classroom.

There are an infinite number of softwares for videoconferencing. However, we believe that it is appropriate to use those that are free (or at least with free plans) so that they do not represent an exceptional cost to the school or the company.

Some of these softwares include:

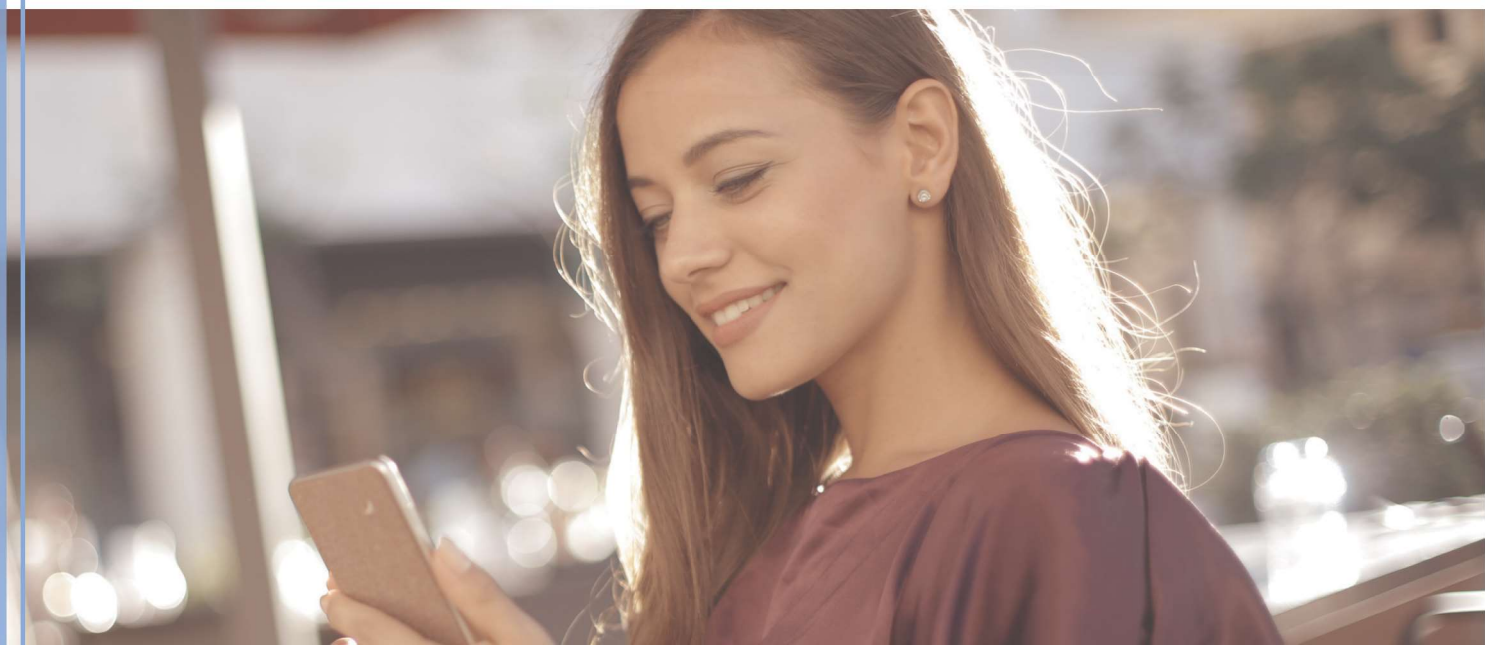
- **Skype**. It is a widely known free software that allows you to make one-on-one and group audio and video calls, as well as communicate via chat. It is a very useful software for carrying out team meetings, since it also has the functionality of sharing the screen of your device, making it easier for students to show their work to the team and for technicians and teachers to make explanations in a simple way.

- **Zoom**. It is a video conferencing and chatting software that has a free plan that offers to hold meetings with a limit of 100 participants and a maximum duration of 40 minutes per meeting. In addition, meeting participants have the ability to share their screen.

Chat

It is a tool that allows you to communicate instantly between two or more users through written messages without video or audio. It's a very useful mechanism to quickly and instantly communicate with the rest of the team without needing to schedule a meeting. For communication between the classroom and the company, chat is very useful for teamwork or even quick questions, allowing you to maintain fluid and stable communication between all team members.

Most video conferencing software (such as Skype or Zoom) has a built-in chat option. However, the educational management software Techvetlab (mentioned at the beginning of this section) recommended for the management and coordination of the project between the classroom and the company has incorporated among its functionalities the chat communication between the participants in the project.



B) Asynchronous communication tools

These tools are those that don't require participants to match at the same time to communicate. The main tool for communicating synchronously is email.

Email is a free messaging service that allows users to send and receive messages instantly over the internet. Among the main email services we find:

- **Gmail**: is a free service developed by Google, available in 72 languages, which can be used from different devices (computers, smartphones or tablets).
- **Outlook online**. It is Microsoft's email service (formerly known as Hotmail). It has a web version and a free app from which you can send and receive messages without having the Microsoft 365 package installed.
- **Thunderbird**. It is the email service developed by the Mozilla Foundation. It's a free, open-source software that allows you to manage multiple email accounts simultaneously.

07

THE ROLE OF THE TEACHER IN THE CLASSROOM

In the first place, and to start this point, we wanted to address it from the itinerary that flows from the general to the more specific aspects that teaching practice in Vocational Training (VET) entails today. In this sense, the role played by the teacher who teaches at this educational level is fundamental to achieve the success of students. In fact, the teacher has a series of responsibilities and tasks, among which the following can be included and highlighted:

- Plan and design the didactic program
- Teach theoretical and practical classes
- Motivate and guide students
- Assess student progress
- Encourage collaborative learning
- Staying up-to-date

TAKS OF THE TEACHER

Plan and design the didactic program

The teacher must design the didactic program according to the needs of the sector, the competences and the specific skills that the students must develop.

Teach theoretical and practical classes

The teacher should give theoretical and practical classes that help students acquire knowledge and practical skills.

Motivate and guide students

The teacher should motivate students to engage in learning and guide them in their learning process, making sure they understand the content and feel comfortable in the classroom.

Assess student progress

The teacher should assess student progress, providing constructive feedback so that they can improve their performance and meet learning objectives.

Encourage collaborative learning

The teacher should encourage collaborative learning, encouraging students to work together on projects and activities that allow them to develop social and teamwork skills.

Stay up-to-date

Teachers must keep up to date with trends and advances in the sector and new technologies, in order to transmit this knowledge to students and prepare them for the demands of the job market.

Thus, and in general terms, the role of the VET teacher in the classroom, workshop or laboratory is to plan and design the didactic programme, give theoretical and practical classes, motivate and guide students, evaluate student progress, promote collaborative learning and keep up to date with the trends of the business sector in which their ptraining modules are related. Without forgetting that the teacher is the one who must have the commitment to motivate and stimulate the student towards the learning process, which aims to prepare students for the world of work and for their personal and professional development.

Both the profile and competencies of VET teachers have evolved significantly

For example, in Spain, the entry into force of the LOGSE in 1990 with the new Intermediate Level (GM) and Higher Level (GS) Training Cycles, considerably dignified VET studies. Likewise, this law differentiated the roles of the teachers who taught at this educational level, all based on the training modules to which they were linked according to their teaching body and specialty. Not surprisingly, the competences between Secondary School Teachers and Technical Teachers were differentiated, framing each of them in a series of training modules assigned to a specific teaching specialty.

This new classification of VET teachers allowed some flexibility when programming the different didactic units, since both in the training modules with an eminently theoretical load, and in those that were more practical, a certain freedom of action was allowed when focusing on the cognitive, practical and procedural part in the VET classroom. This new training action, together with a more global didactic aimed at the activities and skills to be achieved by the students, led to the creation of a direct relationship between the teachers of the Secondary body and the Vocational Training Technicians, thus originating synergies in favor of a more complete training in accordance with the labor market.

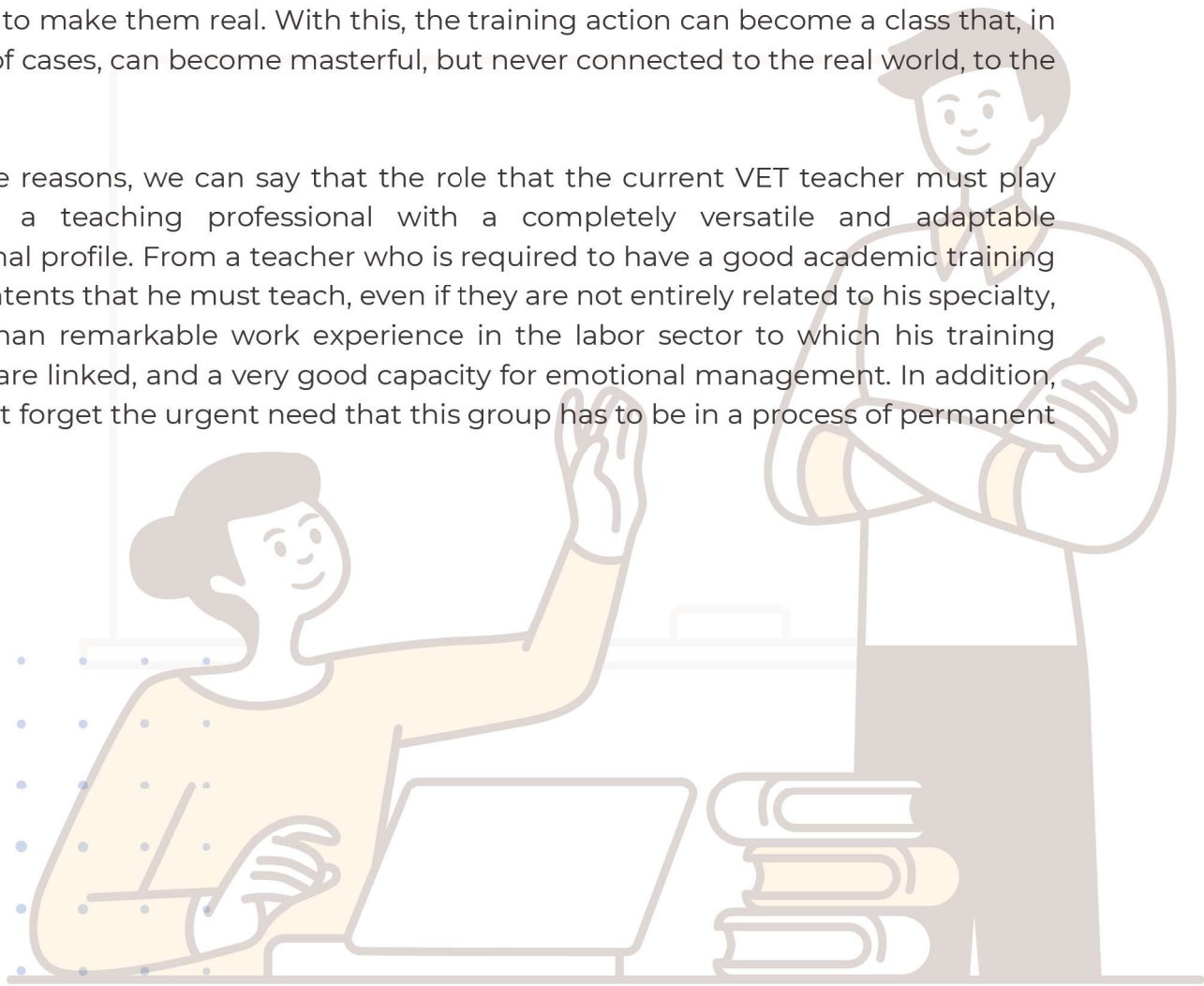
With the approval of the LOE in 2006, the competences of VET teachers were considerably expanded. The exceptional fact that the training module of Technical English was incorporated into the timetable, and, from some autonomous communities, the linguistic qualification was regulated so that those VET teachers who accredited an academic level in English (B2 according to the CEFR), together with an experience and linguistic competence, could teach this training module by conveying their teaching to the English language. All this under the umbrella of an innovative methodology at the time, known as CLIL (Content and Language Integrated Learning).

On the other hand, at the European level, the appearance in the educational landscape of the Erasmus+ Lifelong Learning Programmes from 2013 onwards, specifically, the KA1 and KA2 training actions aimed at VET teachers and students, brought a new breath of life to the studies framed at this academic level. The exceptional fact that VET teachers and students could participate in mobilities related to Job shadowing activities and related to the vocational module of Training in Work Centers (FCT), but in a country in Europe other than the one where the CF had been studied, has since allowed aspects such as the cultural and sociolinguistic component to be part of the overall training action pursued in VET: Global understanding.

In order to carry out the teaching practice in VET successfully, there is no doubt that it is necessary to have the spaces, equipment and budget necessary to offer quality VET in accordance with the current times framed in the era of new technologies.

If we relate everything that has been said so far, we can say that the role of the VET teacher in the classroom is quite different from that of teachers at other educational levels. In other words, the VET teacher needs spaces in which an eminently theoretical training module can be taught, as well as a workshop or laboratory in which the different practices programmed in each of the didactic units can be carried out. This unique fact gives rise to synergies between the teacher, the classroom-workshop and the VET students. So much so that, in many cases, VET teachers have to adjust their annual teaching programmes to the spaces and materials available to them. In fact, one of the most common problems that these teachers encounter is the impossibility of carrying out certain practices or rehearsals because they do not have the necessary materials to make them real. With this, the training action can become a class that, in the best of cases, can become masterful, but never connected to the real world, to the trade.

For all the reasons, we can say that the role that the current VET teacher must play demands a teaching professional with a completely versatile and adaptable professional profile. From a teacher who is required to have a good academic training in the contents that he must teach, even if they are not entirely related to his specialty, a more than remarkable work experience in the labor sector to which his training modules are linked, and a very good capacity for emotional management. In addition, we cannot forget the urgent need that this group has to be in a process of permanent recycling.



Not only when it comes to updating the contents, teaching materials and equipment they need to teach their training modules, but also in all those technological advances, ICTs and other tools that are increasingly demanded by the teaching action. Also in everything related to tutorial action, language skills, Erasmus + lifelong learning programmes, the promotion of reading, extracurricular activities and everything necessary that makes it possible for your training action to become something motivating and stimulating for your students.

In short, and as we have seen, the place occupied by the VET teacher in the classroom, the workshop or in the laboratory is absolutely paramount and non-transferable. In fact, it has a great parallel with that of an orchestra conductor: so that everything sounds in tune and in tempo. Without forgetting the nuances, agogic and dynamic, which make it possible for the new vocational training to generate job opportunities, to meet the main objective of these studies: employability and labor insertion. And, above all, that future technicians are trained as critical people, with sensitivity and decision-making capacity, thanks to quality Vocational Training and in search of training excellence, and that with this the maxim of believing, wanting and being able is fulfilled.

THE ROLE OF THE TEACHER IN THE DEVELOPMENT OF THE PROJECT

The development of the project is only possible in a positive and encouraging classroom environment, where students feel safe to express their ideas because the teacher is constantly encouraging mutual respect, active listening, and valuing every contribution.

The teacher adapts his/her position to observe, encourage, and write down certain facts, which he/she will share with the group. If a problem arises, the teacher can act as a helper, but without solving the problem for the students. They remain available as teachers to offer advice, additional resources, and technical clarification if needed.

7.1

It ensures that the main risks of drift are avoided:

- Risk of the product becoming too important to the detriment of the learning objectives,
- Risk of over-management by the teacher, with students confined to the role of simple executors,
- Risk of lack of framework with a project that reinvents itself as it advances under the pretext of freedom and initiative.

As the technical system is at the heart of the learning process, theoretical contributions linked to practical activities will be given on-site, as needed.

Alone or in association with other teachers, on a case-by-case basis, during the course of the project, the teacher will also be able to construct a didactic situation that allows establishing a theoretical knowledge addressed in the action, or constructing another theoretical situation necessary for this action. These interventions will allow the development of the project to be related to theoretical knowledge in the school curriculum.

Teams start with their work packages according to the established plan.

The teacher guides them in the use of the project management software "Techvetlab", reminding them that familiarity with this type of software can be a learning sub-objective, since they will probably be asked to use similar tools in their professional life. The software facilitates cooperation, file sharing, communication, task assignment, and progress monitoring.

In addition to this highly formalized tool, the teacher encourages cooperation as well as informal and formal communication between students and teams, in particular by organizing regular meetings to make collective presentations, discuss progress, solve problems and share ideas, as well as lead informal discussions in small groups to solve problems or better exercise creative skills to find solutions. It encourages cooperation rather than competition, keeping in mind that cooperation is achieved by acting on the environment rather than coercing individuals. Interest in the project, achievable tasks, free access to different resources, a sense of learning efficiency, and the pleasure of seeing the progress of the project are all contributing factors to this.

During this phase, the teacher continues to act as a facilitator:

- **It encourages everyone to get involved,** ensures that every team member has the opportunity to contribute and share their ideas, and fosters an inclusive environment where every voice is heard and respected, and where even the most timid staff members express themselves and take responsibility.
- **It encourages students to approach problems collectively, think critically,** and work together creatively to find solutions. It also asks students who are more advanced in an area to share their knowledge with their peers.
- **It helps develop communication skills** and encourages students to express their ideas clearly and respectfully. If the teacher has already spent time teaching and practicing effective communication, the project allows them to do so in action, based on the observation of behaviors.

STRATEGIES & ACTIVITIES TO FOSTER THE DEVELOPMENT OF COMMUNICATION SKILLS

Encourage oral participation

Ask open-ended questions, invite students to express their opinions, and encourage discussion among them.

Encourage public speaking

Organize individual or group presentations, debates, or talks in the classroom. This allows students to develop their public speaking skills, structuring their ideas and presenting them clearly and convincingly.

Use role-playing games or simulations

For example, you can have them act out scenarios in which they have to negotiate, resolve conflicts, or present an argument.

Encourage students to write regularly

summaries, workbook use, articles, to develop their ability to organize their thoughts, express themselves clearly, and communicate effectively in writing.

Incorporate the use of different media

(Presentations, videos, photos, blogs, etc.) into students' projects and work to develop their multimedia communication skills and creativity.

Show them the importance of active listening

Encouraging them to listen carefully to others, ask questions to clarify their understanding, and provide relevant answers.

Constructive feedback

Give constructive feedback and ask them to give it to their peers. This helps them identify their strengths and areas where they can gradually improve.

Encourage virtual communication

It encourages the use of forum and synchronous communication in the Techvetlab software to encourage students to communicate and collaborate virtually.

Develop communication skills

Develop communication skills in all subjects, encouraging students to explain their answers, justify their arguments, and express their ideas in a clear and organized manner.

Model clear, respectful, and effective communication

As a teacher, model clear, respectful, and effective communication. Show students how to use appropriate language, listen attentively, and respond constructively to others.

Encourage students to participate in extracurricular activities

such as debate clubs, journalism clubs, or theatrical activities, which provide environments conducive to the development of communication skills.

Regular monitoring of project progress ensures that goals are met and deadlines are met. Intermediate milestones set in the preparation phase allow progress to be checked and adjustments made if necessary. This ongoing assessment helps identify potential issues at an early stage and take appropriate corrective action. It is supported by project reviews, in which the company can participate and which the teacher must ensure are carried out properly to:

- Report on everyone's activities and review the progress of the project,
- Check the documents submitted to prove the results obtained,
- Compare solutions and identify risks,
- Validate the milestones to move on to the next stage,
- Sharing information within the team,
- Make decisions about the future of the project.

A balance needs to be struck between project reviews that are too frequent due to the time they require, which may be the case if they are carried out at each milestone, or too far apart, with three that seem realistic:

- Validation of final specifications, assignment of collective and individual tasks, planning,
- Review of design tasks (individual, team), review of simulation results, review of tasks and planning,
- Evaluation of achievements, analysis of evidence and discrepancies.

The teacher's role is also to highlight the team's successes and the progress made throughout the project. This strengthens the motivation of the students and consolidates the team spirit. This may involve organizing specific moments of celebration, not just once the project has been completed, where the teacher encourages team members to recognize and appreciate each other's efforts.

MECHANISMS FOR ADAPTING CLASSROOM TEACHING PROGRAMMING TO COMPANY-RELATED TRAINING

Identify the company's formation requirements:
It is important to know the needs and requirements of the company in which the students are going to carry out their internship, in order to be able to adapt the didactic programming of the classroom to those specific needs.

Incorporate hands-on experience:
Hands-on classroom activities can be incorporated that allow students to apply the knowledge gained in a realistic and business-relevant environment.

7.2

Work with case studies:
Case studies can be used that reflect real situations that occur in the company, so that students can solve problems and make decisions based on experience.

Encourage collaboration with the company:
It is important to establish a close collaboration with the company to know its needs and that students can develop their internships in a real environment. In this way, the classroom's didactic programming can be adjusted to the specific needs of the company.

Update the didactic program:
It is important to regularly review and update the classroom teaching schedule to ensure that it remains relevant and up-to-date with the needs of the company and the industry.

Integrate state-of-the-art technologies and tools:
In the field of electrical and automated installations, technology is constantly evolving. For this reason, it is important to integrate state-of-the-art technologies and tools into the didactic program, so that students can be prepared to work with the latest technological innovations.

In this sense, it is important to identify the company's training requirements, incorporate practical experience, work with practical cases, encourage collaboration with the company, regularly update the didactic program and integrate state-of-the-art technologies and tools. This way, you can ensure that students are prepared to work in the real world and can meet the needs of the company.

However, how do we reflect these requirements already identified by companies and teachers in the didactic programming of the training module that will be selected? Faced with this issue, we propose a series of actions that we will detail below.

Indeed, when organising and planning the role that the VET teacher will play during the months in which the VET classroom will be linked to a technology company, it will be necessary for this space to be enabled to allow and facilitate the implementation of a project linked to that company. as well as the mechanisms for adapting the programming of the chosen training module during that school period.

STEPS TO ADAPT THE DIDACTIC PROGRAM

STEP 1: CALL FOR A DEPARTMENT MEETING

First of all, we recommend Call a Department Meeting to address the different points that are included in the project proposed by the company. The topics we recommend addressing at this meeting are:

- Reading of the project proposed by the company.
- Selection of the CFGM course in which the BPI methodology will be implemented
- In which training module this methodology will be included
- Who will be the teacher in charge of putting it into practice?
- Requests and Questions

PASO 3: CHOOSE THE SUBJECT

Once all the members of the department are familiar with the project, they go on to select the subject that the teachers consider most suitable to implement the Being a Part of It (BPI) methodology. The distinction of the selected training module is marked and conditioned by various reasons that we will explain.

We recommend discarding the training modules that are taught in the second year, since in many cases students have less training time in the classroom (either due to mobility or the Workplace Training module taught in Spain). For this reason, and because the first year course has three more months of teaching time, we recommend that you choose to study the possibilities offered by the training modules taught in the first year.

ASPECTS TO BE TAKEN INTO ACCOUNT IN THE SELECTION OF THE SUBJECT:

- The versatility of the theoretical content and practices that are contemplated in the annual didactic program of the subject in order to ensure that it is adequate to fit the work plan proposed by the company.

- Although it is not a mandatory requirement, we recommend that the teacher in charge of it has a permanent position in the center, because this type of initiative in the field of extracurricular functions requires personal commitments from teachers who have continuity in the Department. However, the responsibility for bringing this initiative to a successful conclusion lies with all the members of the educational team of this CFGM, since experience indicates that it cannot become a personal action or project, but of an entire Department and with the support of the educational center.

- We recommend taking into account the weekly teaching hours of each subject. Choosing a training module with a high teaching load will provide you with enough hours to put into practice any methodological innovation such as the one proposed in this guide.

STEP 3. DETAIL COMPETENCIES AND LEARNING OUTCOMES

Once the contents to be taught in the selected training module have been planned, we move on to Detail competences and learning outcomes that must be achieved by the students from the development of the teaching action.

As we have mentioned, the main objective of vocational training is to provide students with a series of skills, knowledge and skills so that they can function with ease in the world of work, this will be understood as competence. In order to develop these skills, they are divided into different qualifications that are structured in the different training modules that make up the vocational training.

In this regard, we recommend accessing the information contained in one of the files included in the Europass documents, specifically the so-called Europass Diploma Supplement (https://europa.eu/europass/en/learn-europe/diploma-supplement).

Secondly, we find the learning outcomes, which can be defined as the goals that the student must achieve in this training module in question. In the field of VET, they are called objectives, and all of them are defined in the current legislation of the corresponding country. When students achieve all the learning outcomes, they will also have achieved all the objectives of the module, the vocational training, as well as those related to the vocational training itself.

On the other hand, and associated with the learning outcomes, we find the evaluation criteria that will help us to know if the student has achieved these results.

In short, following this set of recommendations and guidelines, teachers will have the ability to select the appropriate training module to implement the BPI methodology and allow both the teacherand the students to be an active and virtual part in the development of the innovation projects carried out by this technology company.

08

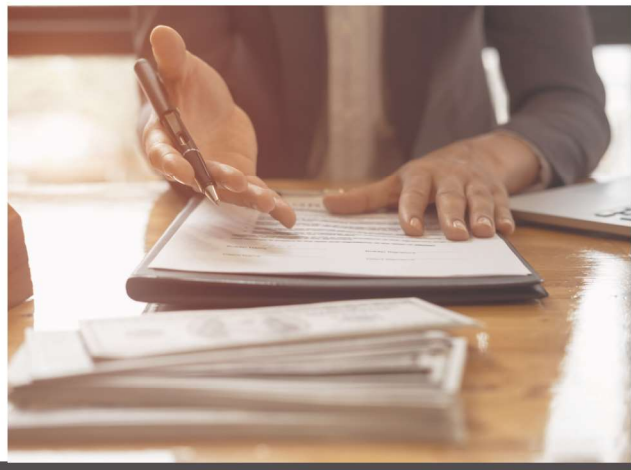
THE ROLE OF THE TUTOR IN THE COMPANY

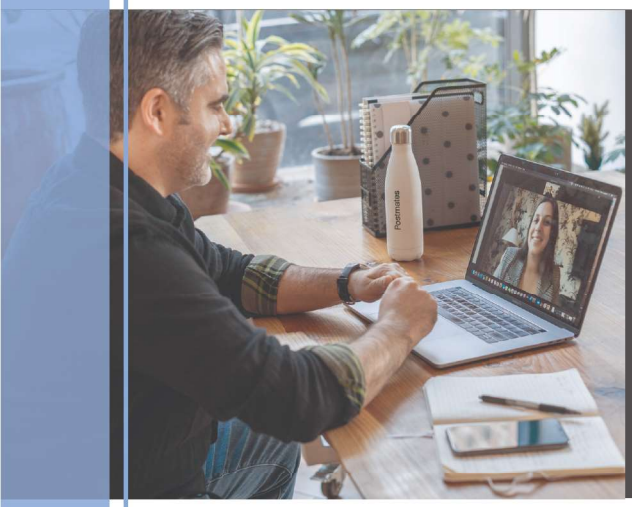
A company's tutor plays an important role in the student's training during the implementation of the BPI methodology. In most cases, these are students who have not had previous contact with any technology company and it is precisely this tutor who is the first way of contact with the world of work and the development of technological projects.

The main tasks of the company tutor can be grouped according to the moment of implementation of the BPI methodology: before, during and after.

PRIOR TO IMPLEMENTATION:

First of all, once the company and the school have signed the appropriate agreements, it is the task of the company's tutor to prepare the detailed work plan of the project in which the students are going to participate. In previous sections, we saw how to write this work plan with all the activities that the students are going to carry out during their participation in the project.





Secondly, it is recommended that both tutors (company and school) have a preliminary meeting in which the first one explains to the teacher the main characteristics of the project, as well as what is expected of the students. We consider that it is a fundamental meeting to clarify the main doubts and establish the bases of communication between the company and the educational center.

Thirdly, in the event that the educational management software "Techvetlab" (recommended by the creators of this methodology) is to be used, the company tutor must register the project in the software, as well as the teacher responsible for the classroom.

DURING IMPLEMENTATION:

First of all, the company's tutor must have virtual meetings with the teacher to monitor the project. The periodicity of these meetings will have been established in the work plan.

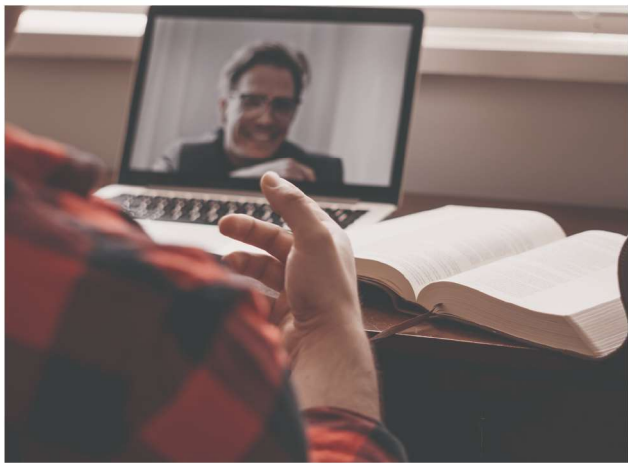
Secondly, you will have to follow up through the "Techvetlab" software, resolving any doubts that may arise to the students, as well as making the comments you consider appropriate on the tasks and their results.

Third, you will have virtual (less occasional) meetings with students. The aim of these meetings is for students to have direct contact with the company, as well as to present the situation of the project and the results obtained to date and to ask the tutor any questions that may arise.

Fourthly, a final virtual meeting will be held in which students will make a presentation of the final work.

POST-IMPLEMENTATION:

After the completion of the project, the tutor must assist the teacher in the evaluation of the project, if necessary. Likewise, if both parties consider it so, an assessment of the work done by the students will be carried out to support the final evaluation carried out by the teacher.



09

AGREEMENTS

Prior to the development of innovation projects, it is necessary to sign the corresponding agreement between a given company and the corresponding educational center. We recommend that this agreement include an agreement that establishes the general framework of the relations between the two entities. The agreement must correctly identify:

- The date and place.
- The signatory parties.
- The objectives.
- The duration period.
- The cases and procedures for termination of the agreement itself.
- The obligations of the parties.
- Specific clauses on issues of interest:
  - Protection of personal data.
  - Confidentiality.
  - Attribution of authorship of results.
- Annexes with the data of participating students and those responsible for each entity in the supervision and coordination.

The agreement will regulate the relations between the parties and the obligations contracted between them, granting them the necessary levels of security for the duration of the relationship.

The parties, legal persons, will act through natural persons who must in turn be correctly identified and will act on behalf of the entities with sufficient recognized capacity to do so, which must in turn be accredited by means of the appropriate documentation (powers of attorney, minutes, etc.) for the full validity of the agreement.

The determination of the general objective of the convention must be made after the determination of the parties involved and their representatives or signatories. It answers the question of what is this agreement for? by means of a summary expression that is as clear as possible.

The duration of the agreement is a basic content. It must state the time of commencement, usually coinciding with the date of its conclusion, and the duration that both parties stipulate as minimum or ordinary. The duration of the agreement must coincide with the time established by the company and the educational center for the participation of a classroom in an innovative project of the company. At this point or at another specific point for this purpose, specific conditions and deadlines for the termination or denunciation of the agreement may be established, so that notice periods and communication procedures are included.

The section that sets out the obligations assumed by the parties must include the specific clauses of the agreement and provide an exhaustive answer to all the issues that each of the entities must face, setting them as specifically as possible and even limiting the deadlines if appropriate.

The convention itself should cover general and important issues such as the processing of personal data, confidentiality issues regarding company data and attribution of authorship over research results. Of these three aspects, the second, linked to confidentiality, transcends the capabilities of the signatories because it concerns the students themselves and could lead to the signing of individual documents by each student if they are of legal age, or by their legal guardians.

Finally, the agreement should incorporate a series of annexes that reflect the data of both the people who, on behalf of each entity, will coordinate and supervise the day-to-day management of the stipulations and the development of the activities involved, as well as the data of the students participating in them.

Below we provide our models of Collaboration agreement between the educational centre and the company for research collaboration, and Model confidentiality agreement.

COLLABORATION AGREEMENT

EDUCATIONAL-BUSINESS CENTRE FOR RESEARCH COLLABORATION

In....., to ... of..... of 20..., gathered on one side:

Mr./Mrs..... with D.N.I ....., as Director of the center....., located in....., province of ....., street/square ..... C.P. ....., with CIF ....., telephone....., and e-mail.....; and on the other:

D./Mrs....., with D.N.I. ..... as the legal representative of the Company or Entity named ..... C.I.F ....., domiciled at....., province of ....., street/square....., C.P. ....., with telephone: ....., and e-mail....., whose main activity is: .....,

EXPOSED

1. That both signatory parties recognize each other's capacity and legitimacy to agree.
2. That the objective of this specific agreement is the collaboration between both entities so that the students of the educational center within the training program ..... Integrate a research classroom to carry out development and innovation work in the company's technological research projects.

AGREE

To sign this collaboration agreement that allows research, development and innovation activities related to the company's own activities to be carried out in the facilities and dependencies of the educational centre that contribute to the comprehensive training of students and that may include, among others, those of:

- Preliminary product design.
- Production design. Study of components. Proof of concept.
- Study of commercial products. Competitiveness studies.
- Commercial design.
- Carrying out training activities included in other modules, or related to innovation projects in which both parties participate.

These activities shall be carried out under the conditions set out in this document which are known and complied with by both parties and in accordance with the following conditions:

CLAUSES

FIRST. The duration of this specific collaboration agreement is ..... years from the date of its signature, being considered extended by calendar annuities, unless there is an express waiver by any of the parties, communicated at least one month before the end of the course [or calendar year]. In addition, this agreement will be terminated immediately when:

- There is a temporary or permanent cessation of activities of the educational center or the company.
- Force majeure makes it impossible to carry out the activities.
- A reasoned complaint is made by one of the parties.
- The centre ceases to provide the training programme that is the subject of this agreement.
- There is a manifest breach of the clauses established herein.

SECOND. This agreement will affect all students of the school enrolled in the training program ..... The centre must submit to the company the list of students and teachers who will participate in these training activities so that it can give its consent. Such a list shall be annexed to this agreement. Any modification thereto shall be immediately communicated in writing to the other party.

THIRD. Both parties will agree on the training programme to be developed by the students in the educational centre so that the classroom is integrated into the planning and research, development and innovation activities of the company, in the achievement of the objectives that are agreed, during the periods of time specified in each case, which will be at least ... hours in annual calculation.

FOURTH. The company will appoint a person responsible for the coordination, monitoring, and guidance of the training activities that the students have to carry out, in coordination with the tutor designated by the educational center. This representative will have the qualifications and legal requirements provided for the performance of the job he or she occupies.

FIFTH. The framework and relationship between the research classroom and [THE COMPANY] will be developed through the educational management software "TECHVETLAB", a free tool created within the framework of the Erasmus+ programme, which allows the creation of a project in which company technicians, teachers and students will be able to work in coordination as a team.

SIXTH. Likewise, at the end of the period of development of the activities or the agreed project, the tutor, in coordination with the person in charge designated by the company, will make the corresponding evaluation reports, based on the laboratory notebooks and the final reports.

SEVENTH. Students will not have, under any circumstances, any employment relationship with the company, so they will be absolutely excluded from the Labour Legislation.

OCTAVE. Employment contracts may not be formalised between students and the company as long as the pupil status of the centre is maintained.

NOVENA. Students will not receive any financial amount for carrying out the training activities, nor for the results that may derive from them.

TENTH. The parties undertake to comply with the health and safety regulations in force at all times. Any accident that may occur will be covered by the School Insurance. The company's representative will inform about the existence of specific risks in the activities to be carried out by the students within the training program.

ELEVENTH. The parties undertake to act at all times with strict attention to the legal provisions in force regarding the protection of personal data.

TWELFTH. The parties enter into a specific confidentiality agreement that commits them to maintain the professional secrecy derived from participation in the research, development and innovation activities of the company both during and after their completion, and even after the termination of this agreement. The reproduction or storage of company data in information retrieval systems, or its total or partial transmission, regardless of the means used, is expressly not permitted without the prior permission of the person responsible for monitoring by the company. The confidentiality of the data and reports obtained during the performance of the training activities, as well as their final results, will be preserved.

Prior to the start of the activities, students must express in writing their agreement with the commitment to confidentiality and will be expressly informed of the obligations arising from the exercise of professional secrecy, personal data, and other confidential information. The same commitment must be signed by the teachers concerned.

THIRTEENTH. When students or teachers wish to use the partial or final results, in part or in full, for publication as an article, conference, or any other use, they must request the company's approval by means of a written request addressed to the person responsible for monitoring the company. In case of

obtaining the company's agreement for the dissemination of results, reference must be made to this agreement.

FOURTEENTH. All the results obtained as a result of the activities carried out by the students will be the property of the company.

FIFTEENTH. The company shall inform its workers' representatives of the content of this agreement.

THE DIRECTOR	THE LEGAL REPRESENTATIVE
FROM THE SCHOOL	COMPANY
(signature and seal)	(signature and seal)

MODEL NON-DISCLOSURE AGREEMENT

(To be signed by the persons mentioned in clause Twelfth of the collaboration agreement)

In....., to .... of..... of 20..., gathered on one side:

D./Dña....., with ID ....., of legal age, domiciled for these purposes in....., province of ....., street/square ..... C.P. ....., phone....., and e-mail..... as [STUDENT / TEACHER] of the [EDUCATIONAL CENTER], on the other hand:

D./Dña....., with D.N.I ..... as Director of the center....., located in....., province of ....., street/square ..... C.P. ....., with CIF ....., telephone....., and e-mail.....; and on the other:

D./Mrs....., with D.N.I. ..... as the legal representative of the Company or Entity named ..... C.I.F ....., domiciled at....., province of ....., street/square....., C.P. ....., with telephone: ....., and e-mail....., whose main activity is: .....,

EXPOSED

1. That the parties sign this Confidentiality Agreement to establish the procedures that will govern the custody, processing and non-transferability to third parties of the reserved information and intellectual rights related to the collaboration project between the [EDUCATIONAL CENTER] and [THE COMPANY] within the training program .... in which [THE STUDENT or PROFESSOR] will be integrated into the corresponding research classroom to carry out development and innovation work in the company's technological research projects.

2. To this end, procedures, obligations and responsibilities are established in this agreement in accordance with the following

CLAUSES

FIRST. Confidential information shall be considered confidential, including but not limited to, that relating to discoveries, concepts, ideas, knowledge, techniques, designs, drawings, drafts, diagrams, texts, models, samples, databases of any kind, applications, programs, brands, logos, as well as any technical, industrial, financial, advertising, business processes, marketing plans, strategic plans, customers, suppliers, know-how, methods, functional analyses, source code, market studies, statistics, financial data, feasibility analysis, technical specifications, formulas, studies, that affected by the LOPD and any other information that [THE COMPANY], regardless of its format of presentation or distribution, does not previously and expressly authorize the [EDUCATIONAL CENTER] to freely use or disseminate.

SECOND. It will not be considered confidential information if it:

- Was publicly accessible at the time of its communication.
- Is publicly disseminated by a creator or legitimate intellectual owner totally unrelated to the framework of this agreement.
- It was known to the parties prior to its communication and was not subject to confidentiality.
- If so established by current legislation or a court order.

THIRD. The parties agree that confidential information provided by the company will only be used in the context of the research classroom, and therefore undertake to maintain the duty of secrecy by maintaining the confidentiality of the information outside this area.

FOURTH. Such information may not be reproduced, modified, disseminated, published or communicated to third parties without the prior and express authorisation of [THE COMPANY]. At the end of the activities related to this agreement, all confidential information will be returned to its rightful owner, regardless of the medium or whether it is an original or a copy.

FIFTH. The parties shall scrupulously comply with the daily personal obligations arising from the security measures that the [EDUCATIONAL CENTRE] will apply both as required by current legislation and by agreement with [THE COMPANY] to guarantee confidentiality.

SIXTH. The information provided by [THE COMPANY] is the intellectual property of [THE COMPANY]. The results of the work carried out within the framework of the research classroom and the corresponding agreement will also be the property of [THE COMPANY]. Its dissemination or misuse, whether negligently or fraudulently, will result in liability and appropriate compensation.

SEVENTH. This agreement will be valid for the duration of the activities of the research classroom, but its effects will be extended thereafter under the current legislation regarding the protection of intellectual property and the confidentiality of [THE COMPANY's] own data.

And by virtue of the foregoing, both parties sign this agreement in duplicate, on all its pages, at the place and date aforesaid.

El/La- A TEACHER	THE DIRECTOR FROM THE SCHOOL	THE LEGAL REPRESENTATIVE OF THE COMPANY
(signature)	(signature and seal)	(signature and seal)

10

EVALUATION MECHANISMS

Evaluating involves determining the value or meaning of something in a systematic way based on a series of criteria and standards. When evaluating, value judgments are made and an opinion is expressed that should ideally be as objective as possible, guided by the uniformity of previously determined criteria. Comparative and quantitative tools are used in the evaluation process. Evaluation is a basic instrument both in the educational process and in the implementation of quality systems.

Traditionally, it is carried out through examinations and tests, allowing us to judge the achievement of objectives and guiding decision-making. In the educational framework, it has traditionally been aimed at qualifying the level of knowledge acquired by a person, while at the same time carrying out assessments related to skills and attitudes, but, however, it does not usually extend to values. There are two main evaluation mechanisms in our work methodology: the Workbook and the Final Report.

The students will prepare an ad hoc questionnaire validated by the teacher that will measure the satisfaction of the students in the development of the project. Measuring user satisfaction should be seen as an integral part of the project, and the findings will be presented, along with the project, to the partner company. However, company satisfaction can only be measured after the presentation phase.

Once the projects are finished, the teacher will organize a presentation session where each team can share their work with the class or with other classes. Students will explain their development process, functionalities and answer questions from their classmates. This will showcase their work, boost their self-confidence, and stimulate interest in technology projects within the school. The result of the evaluation can also be shared at other times, at school or at local events, to show the school's cooperation with companies.

Assessment, under the responsibility of the teacher, encompasses several dimensions. The results obtained in relation to the objectives set, during and at the end of the project, and the approach followed, are evaluated collectively, with the participation of the partner company.

Formative assessment, which follows the progress of the project and is regulated by the teacher, aims to improve and enhance:

- Teamwork
- Attitudes and competences

Actively engaging students, which not only develops their self-assessment and comparison skills, but also helps them understand their own learning and develop appropriate strategies for learning how to learn.

The following table provides a non-exhaustive list of unclassified items that can be evaluated, regardless of the mechanism used.

Attitudes	Transversal skills
Pragmatism	Acknowledging mistakes, being able to be self-critical
Ability to give ideas	Analysis of the environment
Taking the Initiative	Searching for information
Investment in tasks	Identifying Your Needs
Enthusiastic	Able to evaluate himself
Autonomy	Work as a team
Ability to lead the group	Communicating with others
Constructive	Be a Good Listener
Determination	Able to mediate
Empathy	Prioritization
Curiosity	Organize your work
Eagerness to learn	Ask for advice and feedback
Meticulous and caring	Emergency Management
Meticulous	Problem Solving
Useful	Coping with Stress
Persevering	Learn independently
Creative	Classification Information
Adaptation	Managing Complex Situations

For each item, for example, it is possible to use parallel scales, the first marked by the student as a self-assessment, the second marked in pairs, after an exchange with the teacher or another student.

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

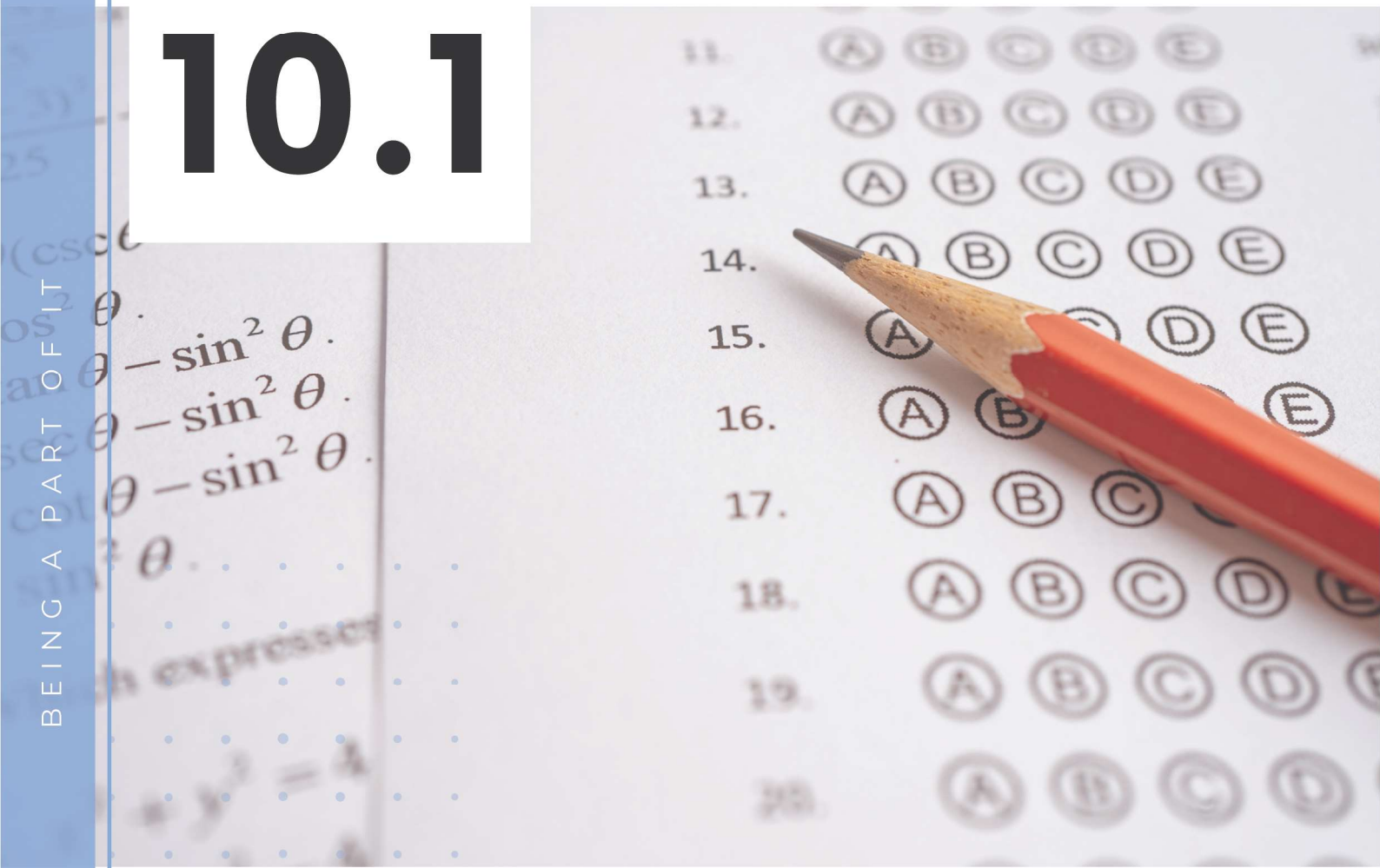
This evaluation work will, of course, have been prepared in advance and fed into the project by the active observation of the teacher. The rate at which observations are recorded will depend on the project and the weekly schedule. They make it possible to evaluate individual and collective contributions and highlight developments when evaluating team-building activities.

MOTIVATION ASSESMENT

The methodology Being a part of it, BPI, as other teaching methods based on projects or case analysis, such as Case-based learning, CBL, is expected to promote in students a special motivation for learning. It is also expected the development of transversal skills such as autonomous learning techniques, group work, oral and written expression, critical thinking and others that will be important in their vocational studies and in their later professional career.

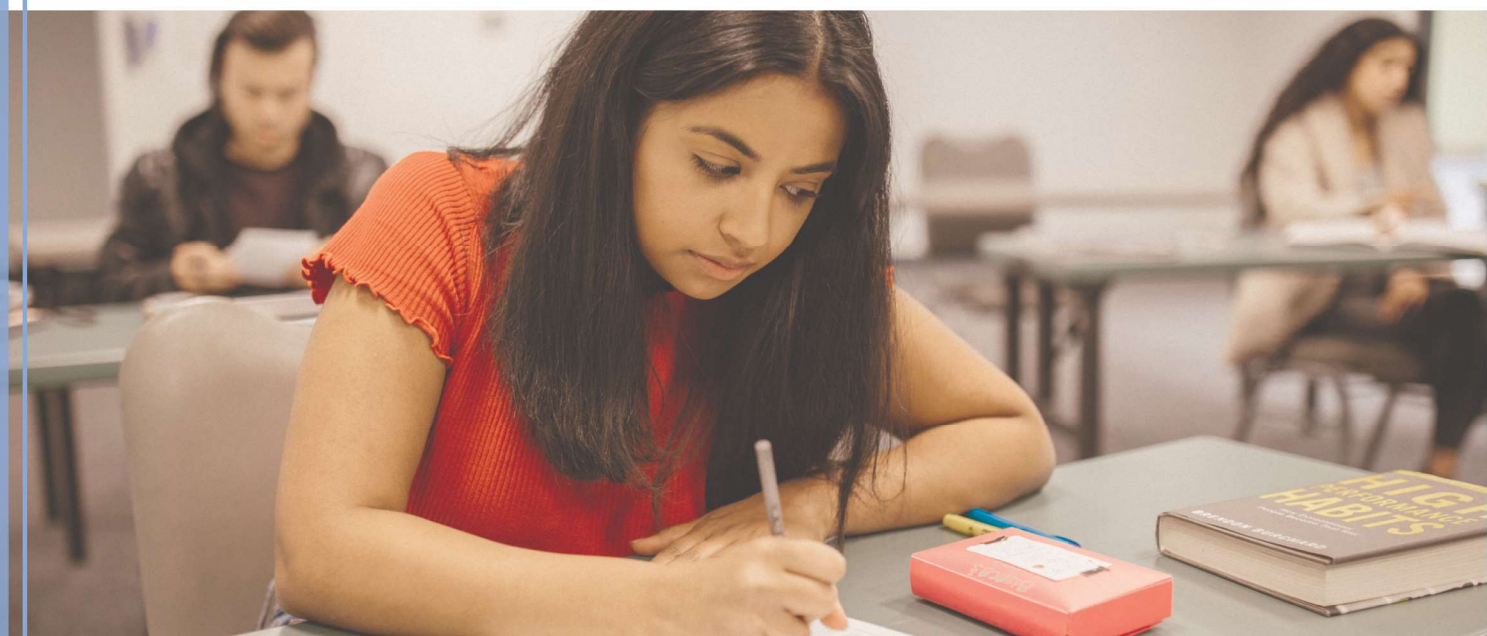
The study and evaluation of motivation in students at any level of education is a basic aspect of the educational process since much of the success in the teaching-learning process depends on factors related to motivation [Reigeluth 2016]. The analysis of motivation in students to be conclusive regarding the effectiveness of a particular methodology needs a model that articulates the evaluation. In this sense the ACRS (Attention, Confidence, Relevance, Satisfaction) model proposed by Keller in 2010 provides a structure for assessment based on his conception of the motivational design of learning.

10.1



This procedure allows the teacher to analyze student motivation in response to the introduction of a given teaching material. The procedure is applicable to students from different educational systems, from high school to university [Keller 2010, Rodríguez Bailón 2021]. The model proposes four fundamental elements in motivation: attention, confidence, relevance and satisfaction. The attention element refers to how the methodology or teaching materials are able to capture the curiosity, enthusiasm and interest of the students, making the student have an active attitude towards learning due to the novelty it implies for him/her. Relevance has to do with how the student connects the teaching materials and methods with his learning needs, his/her goals and previous experiences and also with his/her preferences in relation to the study. Confidence has to do with the feeling of personal control and the expected success at the end of the learning process with the methodology used. Satisfaction refers to the positivity with which the student faces the learning process.

These four fields of analysis are evaluated by means of a survey in which the student is asked a series of statements with which he/she agrees or disagrees with a numerical value from 1 to 5. Part of these questions refer to each of the fields in such a way that finally a numerical value and an uncertainty for each of the fields can be obtained to compare the results of an analysis group with a control group.



The hypothesis of the study is that the fact of starting vocational training studies by participating in a development project proposed by a company will be an important motivating factor for students in their future studies in the vocational training center and their future career.

Method.

The study seeks to answer the question: Does the fact of having carried out the internship following the BPI methodology have a positive influence on the student's motivation for their vocational training studies?

It is based on a survey of 34 questions, following the ACRS model of the "Course Interest Survey" (Keller 2010), adapting the language of the questions posed to the level of studies corresponding to the beginning of vocational training studies. Responses are rated with a score: 1: Not true, 2: Slightly true, 3: Moderately true, 4: Mostly true, 5: Very true.

Scoring guide for the Course Interest Survey

Attention	Relevance	Confidence	Satisfaction
1	2	3	7(reverse)
2 (reverse)	5	6 (reverse)	12
10	8 (reverse)	9	14
15	13	11 (reverse)	16
21	20	17 (reverse)	18
24	22	27	19
26 (reverse)	23	30	31 (reverse)
29	25 (reverse)	34	32
	28		33
* There are questions posed in negative form, the assigned values should be taken in reverse order, i.e. 1 is 5, 2 is 4 3 is 3, 4 is 2 and 5 is 1.			

Data analysis

The mean values of the scores assigned by the students will be used, obtaining an evaluation for each of the fields and the sum of the four will be considered the final evaluation of motivation.

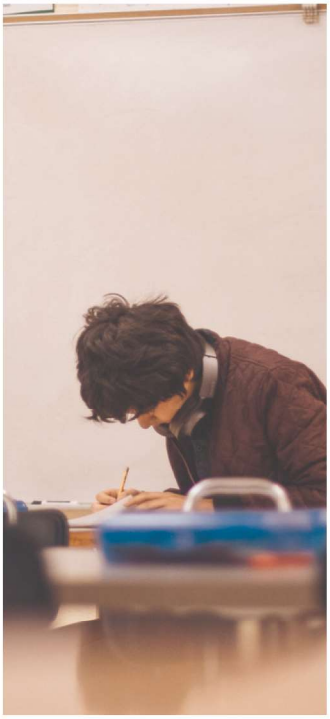
	1	2	3	4	5
1. The instructor knows how to make us feel enthusiastic about the subject matter of this course.					
2. The things I am learning in this VET course will be useful to me.					
3. I feel confident that I will do well in this VET course.					
4. This class has very little in it that captures my attention.					
5. The teachers make the subject matter of this VET course seem important.					
6. You have to be lucky to get good grades in this course.					
7. I have to work too hard to succeed in this course.					
8. I do NOT see how the content of this VET course relates to anything I already know.					
9. Whether or not I succeed in this VET course is up to me.					
10. The teachers create suspense when building up to a point.					
11. The subject matter of this VET course is just too difficult for me.					
12. I feel that this course gives me a lot of satisfaction.					
13. In this class, I try to set and achieve high standards of excellence.					
14. I feel that the grades or other recognition I receive are fair compared to other students					
15. The students in this class seem curious about the subject matter.					
16. I enjoy working for this course.					
17. It is difficult to predict what grade the teachers will give my assignments.					
18. I am pleased with the instructor's evaluations of my work compared to how well I think I have done.					
19. I feel satisfied with what I am getting from this course.					
20. The content of this course relates to my expectations and goals.					
21. The teachers does unusual or surprising things that are interesting.					
22. The students actively participate in this class.					
23. To accomplish my goals, it is important that I do well in this course.					
24. The teachers use an interesting variety of teaching techniques.					
25. I do NOT think I will benefit much from this course.					
26. I often daydream while in this class.					
27. As I am taking this class, I believe that I can succeed if I try hard enough.					
28. The personal benefits of VET studies are clear to me.					
29. My curiosity is often stimulated by the questions asked or the problems given on the subject matter in this class.					
30. I find the challenge level in this course to be about right: neither too easy not too hard.					
31. I feel rather disappointed with this VET course.					
32. I feel that I get enough recognition of my work in this course by means of grades, comments, or other feedback.					
33. The amount of work I have to do is appropriate for this type of course.					
34. I get enough feedback to know how well I am doing.					

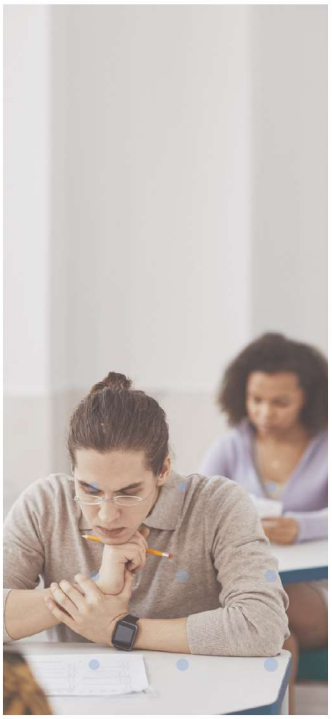
THE WORK NOTEBOOK

The Workbook is a primary record of work and research. It serves to document the activities carried out in the laboratory within the framework of the scientific method, accompanied by the formulation of hypotheses and design of experiments, as well as their initial interpretation. It is also a tool for organizing laboratory work, for memory safeguarding. It also makes an important contribution to the development of critical thinking, reflection and the evaluation of alternatives. It is also an instrument that helps to establish orderly methodologies and work routines.

The Workbook must be written individually by each student on a daily basis. The guidelines may be adapted to the specific circumstances of the centre and the work to be carried out, but at least they must be adapted to those that are in general use in the field of research: binding, manuscript, pre-numbered pages, ordering of entries by date, pasting on the page of the corresponding date the contents that cannot be transcribed and have been printed by other procedures, Use of indelible means of writing, do not resort to the use of loose sheets, it must be the original place of record of daily and uninterrupted use. It is a diary, not a work structured by concepts, in which the expression of ideas and hypotheses acquires a prominent role together with the development of experiments to corroborate, refute or rework them.

10.2





WHAT SHOULD THE STUDENT WRITE IN THE WORK NOTEBOOK?

- **Objectives.** Effectively understanding the objectives that the teacher will set on a daily basis.
- **Tasks.** Explaining the ones you need to do.
- **Hypothesis.** Setting out those that the laboratory work is going to deal with.
- **Methodology.** Reasoning the one you are going to use.
- **Description of actions.** Explicitly, in detail and meticulously of each step taken and the results obtained.
- **Evaluation of results.** Assess whether or not they support the hypothesis proposed and therefore the success or possible errors made.
- **Reproducibility evaluation and methods.**
- **Evaluation of the hypotheses** and whether they should be subjected to new tests, abandoned after those carried out or can be reworked.
- **Communication of results** to the team and comments provided by other members.

STRUCTURE

APPROACH

The work to be done should be introduced, describing the essay or task and the area of the company or project in which it is included. Subsequently, the working hypotheses and expected results will be formulated. The difficulties and possible solutions must be assessed. Finally, the methodology, work plan and risk prevention will be described.

RESULTS

This second section is the most important, as it includes a detailed explanation of the tests carried out and the results obtained. Throughout the development of these processes, special attention should be paid to reasoning, reflections and possible errors. It is very important to ask relevant questions, as well as seek pertinent information, while persevering in the work.

ANALYSIS

After the completion of the tests or tasks, the results obtained must be evaluated. It is necessary to analyze whether they coincide with those expected based on the hypotheses formulated. If not, you have to try to establish why. In addition, its validity must be established and the need for repetition of the test and the feasibility of its replication by anyone must be assessed. Subsequently, the contributions obtained from the conversations with the project partners and the teacher must be included. Finally, the conclusions reached will be recorded.

HABITS AND ATTITUDES THAT THE WORK NOTEBOOK FAVORS:

- It keeps you proactive.
- It involves reflecting on what is written and the conduct to be followed.
- It requires deliberate structuring of ideas and concepts by relating them to previous knowledge.
- It facilitates various forms of expression.
- It favours the organisation of the experience lived in the formation.
- It facilitates the reconstruction of processes and thus illustrates the evolution of learning.
- It favors the structuring, synthesis and analysis of information.
- Encourage self-analysis.
- It facilitates the transformation of practice.

The work notebook is a real diary of learning; a fundamental instrument for assessing students, not only in terms of knowledge but also in terms of attitudes and skills; and not only by the teacher, but also for the students themselves to carry out a self-assessment exercise

However, it is convenient to use the final project report to offer third parties this overview, also becoming the other fundamental means of student evaluation.

THE FINAL REPORT

The final report must be based on the contents of the Workbook in order to present an orderly and coherent overview of the entire research process carried out. To do this, a structure must be adopted that summarizes some basic points:

- Title.
- Summary.
- Initial objectives.
- Objectives achieved.
- Methodology used.
- Resources used.
- Development of activities.
- Results.
- References.
- Annexes.

Depending on the contents and specific development of the research, this basic proposal for a scheme must be adapted to its peculiarities.

It also contributes to developing the ability to structure concepts and a discourse that makes what you want to communicate understandable.

10.3

BASIC QUESTIONS THAT THE STUDENT MUST ANALYZE BEFORE PRESENTING THE FINAL REPORT

- Does the title illustrate the content of the work?
- The summary: does it include the main issues? Is it comprehensible and brief?
- Does the work start from a well-developed theoretical framework?
- Are the objectives of the work correctly formulated?
- Is the methodology followed adequately described?
- Is the data well-founded? Are they relevant?
- Are the conclusions interesting? Are they well supported by data?
- Is it well written? Is the expression clear and precise? Is it well presented?
- Have the most relevant background information been correctly cited? What about the bibliographic references?

Beyond the use of written language, the report must include resources of various types that illustrate the content of the research and its results, through graphs, images, tables, etc. so that clarity and relevance are evident.

The final report will require the writing and correction of the language used to be taken care of in a more careful way than that used in the laboratory notebook, helping the student to understand the importance of writing for the communication of results to third parties.

The final report is presented with a double objective: dissemination of results and learning exercise. The dissemination of results will be restricted to the existing agreement with the collaborating company or entity which, in accordance with the agreement signed with the educational center, is the one who has to previously authorize any other area of dissemination of the report. In any case, the report will serve as a learning exercise for students and to be an important element in evaluating their progress.

11

ACCREDITATION OF COMPETENCES

In this section we focus on analysing how the participation of a student in a research project, following the BPI methodology, such as those proposed in this guide, can contribute to the development of the key competences that students are expected to achieve at the end of vocational training, in line with the Recommendation of the Council of the European Union of 22 May 2018 on key competences for lifelong learning. Official Journal of the European Union 4/6/201. This recommendation defines competences as a combination of knowledge, skills and attitudes. Competences "integrate skills such as critical thinking, problem-solving, teamwork, communication and negotiation skills, creativity, and intercultural skills," while attitudes "describe the mindset and willingness to act or react to ideas, people, or situations."

Eight key competences are established: literacy proficiency, multilingual proficiency, mathematical proficiency and science, technology, and engineering proficiency, digital proficiency, personal, social, and learning-to-learn competence, citizenship proficiency, entrepreneurial proficiency, and competence in cultural awareness and expression. These competences are absolutely interdependent and are progressively achieved throughout basic education.

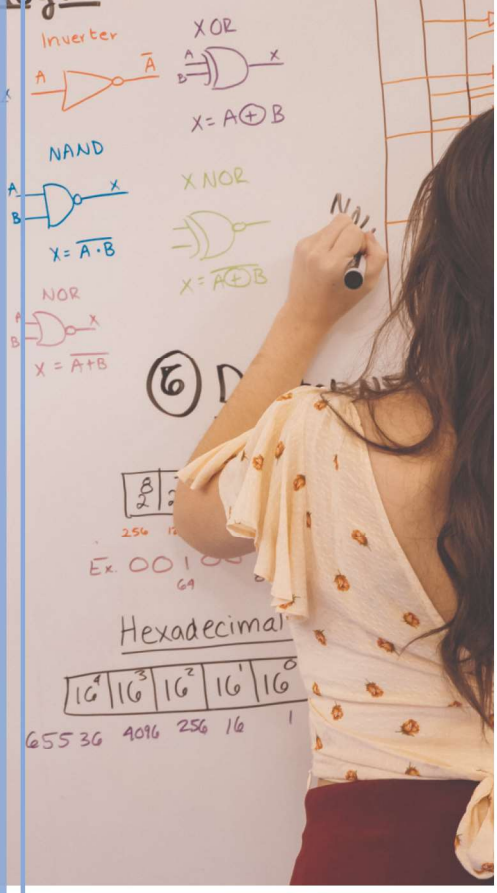
The BPI methodology is focused on involving students in a creative process, carried out in a group and under the direction of a teacher and a technician from a technology company. The activities that the student will carry out in this process, at the beginning of their vocational training studies, will show them the importance of acquiring these key competences, the student will see the importance of acquiring the knowledge, skills and attitudes that are required to succeed in a specific objective and will probably see what is the path to grow in the acquisition of those competences. Below we see the relationship between the activities that the student carries out in the research project and the key competences most related to the development of the professional career in technology companies.

LINGUISTIC COMMUNICATION COMPETENCE

According to the operational descriptors of this competence, at the end of basic education the student is expected to express himself orally or in writing coherently, correctly, with a cooperative and respectful attitude, to understand and interpret and critically evaluate oral or written texts in order to participate actively and informedly in different contexts. that progressively autonomously locates and contrasts information from different sources, that reads progressively more complex texts autonomously, that puts its communicative practices at the service of democratic coexistence, the resolution of conflicts through dialogue and the equal rights of all people.

In this direction, the projects proposed by the BPI methodology are proposed as group work, involving a complete classroom. The work plan is divided into distinct tasks that are performed in smaller subgroups. It is important that you set an overall goal for classroom work. The success or failure in the development of the project is the responsibility of the whole group. Day by day, it is necessary to make decisions, which requires a dialogue within each subgroup that performs a specific task, a way of communicating within the group and from the group to the classroom as a whole. With the help of the teacher, it will be shown that the skills of effective and respectful communication and resolution of discrepancies that arise is essential to advance in the completion of a task or in the achievement of specific objectives. On the other hand, as we have seen in the examples of work plans in the previous sections, especially at the beginning of the project, activities are proposed to search for information, the understanding of the chosen texts, the organization of this information and the communication to the rest of the colleagues in a summarized and effective way. This activity of informing oneself and teaching others is difficult for students who begin vocational training studies, they are skills that will be progressively acquired throughout their training. The writing of the workbook and the final project report contribute to the development of knowledge related to vocabulary, grammar and language functions, while developing both skills to use different linguistic registers, collect and process information and express one's own arguments as well as positive attitudes towards communication and interaction with other people.

Joining an innovative project clearly shows students the importance of acquiring these skills and how language ability has an impact on their integration into the group, their personal satisfaction and the achievement of their own goals and those of the group as a whole.



COMPETENCE IN MATHEMATICS AND SCIENCE, TECHNOLOGY AND ENGINEERING

According to the descriptors of this competence, students are expected to use inductive and deductive methods in familiar situations at the end of their basic training, to select and employ problem-solving strategies and critically analyze the solutions found (STEM1), to use scientific thinking, asking questions and testing hypotheses through experimentation and inquiry, showing a critical attitude towards the scope and limitations of science (STEM2) that proposes and develops projects by designing and manufacturing prototypes or models to generate or use products that provide a solution to a need or problem in a creative way and seeking the participation of the whole group (STEM3), that interpret and transmit the most relevant elements of processes or reasoning (STEM4) and that undertake scientifically based actions to promote physical and mental health and preserve the environment and beings Alive (STEM5)

Many of the specific aspects related to this competence are not easy to acquire if they are presented to the student in isolation in the different subjects they are studying or through concrete examples, academic problems or texts.

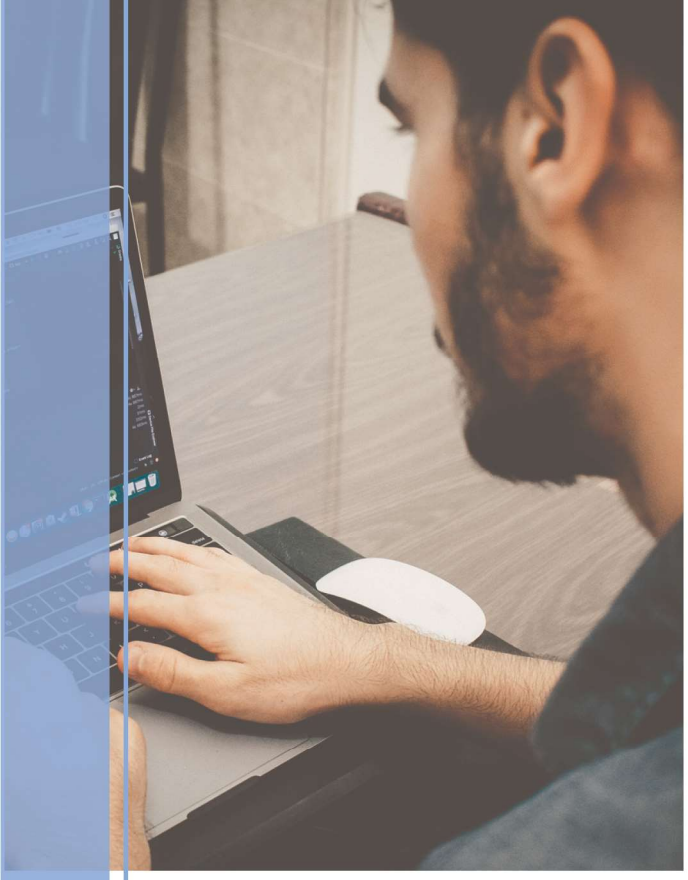
The abilities to apply mathematical principles and evaluate argument chains by reasoning mathematically will develop in parallel with the skills to manipulate technological tools and handle scientific concepts and data to reach evidence-based conclusions. All of this is complemented by the development of positive attitudes towards mathematics and scientific progress through curiosity and critical thinking.

The fact of setting a global and difficult objective in the field of technological innovation makes very evident the importance of facing professional activity following the scientific method in line with the descriptors of this competence. The student will see how intuition is not enough to move in the direction of achieving a technological goal, that providing a solution to a problem or a need requires method, critical and scientific thinking. Participation in a research project is an important contribution to the student's conviction of the value of dedicating an effort to acquire these methodologies of reasoning and work. In the projects proposed by the BPI methodology, a large part of the tasks are dedicated to the analysis of the proposals, designs, or models advanced by the group, and to their discussion with the technicians of a technology company, accustomed to innovation. It will be seen immediately that not just any proposal will do, that it is necessary to carefully analyze the reasoning or evidence that leads to consider that this proposal will go in the direction of achieving the objectives set out in the project.

MULTILINGUAL PROFICIENCY

In relation to this competence, it is expected that at the end of their vocational training studies the student will effectively use one or more languages other than their own, make transfers between the different languages as a strategy to communicate and expand their individual linguistic repertoire and know, value and respect the linguistic and cultural diversity present in society.

In the European network of companies and vocational training training centres that has been integrated into this Erasmus + project, technology companies from different countries will be present and will propose projects to be carried out by students in training centres in other countries. Students will have to communicate continuously with their tutors in the company, using the language that allows that communication, in most cases English. Students will have to listen to and understand the explanations given to them in another language and will prepare presentations of their results that can be understood by their tutor in the foreign company. It is clear that in group work, those students with a greater command of English will be the ones who participate the most in this communication and also the ones who will benefit the most from the project in terms of the acquisition of multilingual competence. It is known that people with some previous language proficiency benefit more from relatively short-term immersion in a foreign language than those with poor initial knowledge of the foreign language. But, in any case, it will be evident to all students that mastery of languages other than their own is an essential communication tool in the development of their professional career. On the other hand, in the search for documentation that we have already talked about in relation to other competences, it will be seen that in the field of technology much of the information pertinent to a specific project is available only in English and students will have to deal with the handling of these texts.



DIGITAL COMPETENCE

In relation to this competence, students are expected to be able to search the internet critically according to criteria of validity, quality, timeliness and reliability. They should also use digital tools for processing information, adapting them to the task they are already carrying out and their lifelong learning needs. Communicate and exchange information using virtual tools or platforms. Identify risks and take preventative measures to protect devices and personal data. To develop simple computer applications and sustainable technological solutions.

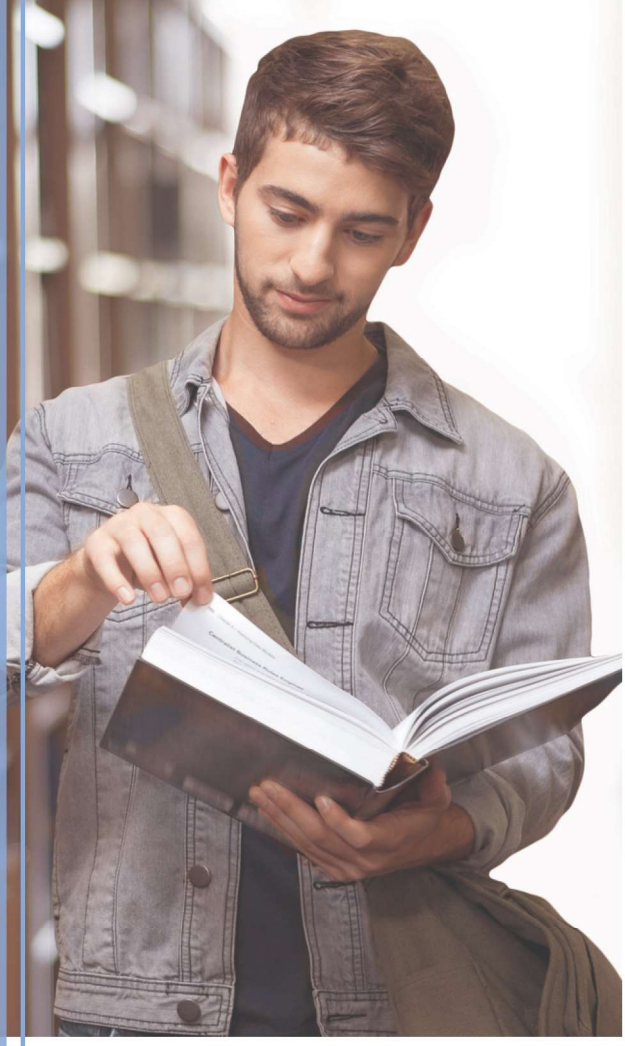
The projects proposed with the BPI methodology will be based in most cases on digital environments, as seen in the examples included in this guide: computer-aided design software is used, digital data analysis tools are used, etc. On the other hand, the search for information related to the specific project to be carried out will be carried out on the internet and special emphasis is placed on critical thinking skills that allow the reliability of the information obtained to be analyzed. Emphasis is also placed on the digital tools for organising the information collected and presenting it, both to colleagues in the work group and to tutors in the company and in the classroom through digital means. Communication between the classroom and the company will necessarily be carried out by digital means and will show students the power of the tools used and their importance in the development of their professional careers.Both the use of the educational management software "TECHVETLAB" and software for the development of the project's tasks, as well as the use of various computer tools for the drafting of the final project report, will contribute to the development of new knowledge related to applications and digital environments. The framework of NDAs will help to reflect on the potential opportunities and risks offered by the Internet and electronic communication. Research and memory will help to understand the possibilities that ICTs offer for obtaining information and supporting creativity. Thus, the ability to seek and obtain information must be complemented by an attitude of critical and reflective approach to information and its sources.

ENTREPRENEURIAL COMPETENCE

It is expected that the student, at the end of their training in this educational stage, will be able to analyse needs and opportunities and face challenges with a critical sense, taking stock of their sustainability and assessing the impact they may have on the environment. You must assess your strengths and weaknesses using self-awareness and self-efficacy strategies and understand the basic principles of economics and finance and apply this knowledge to concrete situations. You will also be expected to develop the process of creating valuable ideas and solutions and making decisions in a reasoned manner, that you will be able to create innovative and valuable prototypes.

In relation to this competence, we give special value to the example that the technology company proposing the project sets for students. At the beginning of the project, special importance is given to the company explaining to the students how the objectives of the project that are proposed to them fit into one of the company's lines of business. Either on their own initiative or in response to the curiosity of the students, they will talk about the origin of the company, which will probably have been born on the initiative of some researchers and will be based on a technological development that arose from their own research. At least this is the case of the companies currently integrated into the network of this Erasmus+ project. On the other hand, it is essential that the project sets a realistic objective for which the whole classroom is responsible and that this objective is finalist, that the project leads to a creation that the students see as their own. We hope that this creative process will be motivating for the student and show them their own ability to undertake innovative activities.

Training in this competence will be favoured by developing the ability to transform ideas into actions, fostering creativity, thanks to the scientific method that guides research. Students will learn to know and recognize the opportunities that exist when they come into direct contact with the productive and business environment. Skills related to the planning, organization and management of research activities will also be developed. The entrepreneurial attitude is characterized by initiative, proactivity, independence and innovation, elements that will be favored both by research and by contact with the business environment.



PERSONAL, SOCIAL AND LEARN-TO-LEARN COMPETENCE

Upon completion of basic education, the student must regulate and express emotions, strengthening optimism, resilience, self-efficacy and the search for purpose and motivation towards learning. That consolidates healthy lifestyles. Proactively understand other people's perspectives and experiences and incorporate them into their learning to participate in group work by accepting tasks and responsibilities. To carry out self-evaluations of their learning process and to set medium-term objectives and develop metacognitive feedback processes to learn from their mistakes in the process of knowledge construction.

In this sense, group work on a project with a common goal is a powerful tool to make students see the importance of critical thinking skills in communication with other people, intellectual honesty, the ability to self-evaluate their reasoning and critically analyze the information they receive from other people and from the media or scientific or technical publications. In the development of the project, the student will see which way of approaching the learning necessary to carry out the work is most effective for him and how the interaction with the colleagues of the group can make the objectives be achieved efficiently or that the work is an absolute waste of time and effort.The role of the teacher in the classroom can be very important in the sense of detecting and making students aware of communication problems or ways of approaching self-learning that arise.

CIVIC COMPETENCE

Students are expected to analyze and understand ideas regarding the social and civic dimension of their own identity, demonstrating respect for norms, empathy, fairness, and a constructive spirit in interacting with others in any context. That it analyses and assumes the principles and values that emanate from the process of European integration. To analyse and understand fundamental and current ethical problems. That understands the systemic relationships of interdependence, eco-dependence and interconnection between local and global actions.

In relation to this capacity, the student's participation in the project implies an immersion in a project resulting from European integration in which companies and educational centers from other European countries contribute to their own vocational training. It also opens up the prospects for the future within the European Union. Depending on the theme of the project, the impact that industrial manufacturing processes have on the global environment will be highlighted to a greater or lesser extent. It is the role of tutors, both in the company and in the classroom, to open up the discussion of these aspects among students and encourage them to reflect, seek information and analyse the sustainability of manufacturing processes and their impact on the environment, for example, by focusing on the recycling capacity of the materials used in their designs or the treatment of waste in the industrial processes involved

CULTURAL AWARENESS AND EXPRESIÓN COMPETENCE

Students must know and critically appreciate and respect cultural and artistic heritage, getting involved in its conservation and valuing the inherent enrichment of cultural and artistic diversity. They must enjoy and analyze the most outstanding artistic and cultural manifestations autonomously. To express ideas, opinions, feelings and emotions through cultural and artistic productions and to know, select and use creatively various media and supports.

Although the BPI methodology has not proposed specific activities related to competence in cultural awareness and expression, the fact of proposing creative activities in the field of technology to students from the beginning of their training can make them relate more openly to the cultural and artistic expressions of their environment. In the examples of specific work plans that we saw in the previous section, technological projects related to plastic, visual, audiovisual or sound techniques have not been raised, but this possibility is undoubtedly open given the importance of the integration of technology and art expressed in the most diverse forms.

12

CERTIFICATION PROCESSES

Before continuing to analyse the tools that have been developed for the recognition and validation of the learning outcomes that learners are acquiring as a result of their participation in informal and non-formal training activities, it is worth considering the BEING A PART OF IT methodology as a tool to help learners acquire modern skills and competences that will help them ensure a good educational and career path.

VET aims to equip young people and adults with knowledge, competences and skills, so that they can practice a profession, develop themselves personally and adapt to the transformation of society and the economy into a greener and more digital version.

INITIATIVES

Updating your organisation and operation of on-the-job training. Participants in workplace training programs should be provided with up-to-date, evidence-based knowledge and skills that enable them to respond to market demands. To achieve this, providers must have the autonomy and flexibility to design training programs that produce the desired outcomes.

VET is a field linked to personal and professional development and social welfare.

The results of properly designed and functional VET are disseminated horizontally in society and contribute to the development of social justice and equality.

The flexibility and structuring of learning outcomes in a way that is adapted to the needs of individuals and the labour market. The development of mechanisms, assessment and certification is an important chapter both for the parts of which a qualification is composed, and for the qualification as a whole.

The development and operation of CoEVs is a primary concern for the interconnection of VET with the labour market. The development of modern technological infrastructures, incorporating digital technology, supports the effectiveness of structures.

Continuous improvement of the knowledge and skills of teachers and learners is an option with a strong impact on the quality of VET. Transnational mobility, which gives people the opportunity to carry out internships in companies, can be used to develop skills in a simple and understandable way for graduates to develop a modern profile, which makes them competitive in the labour market and ensures favourable prospects for their personal and professional development.

What is required, in any case, is that the training activities that are developed, andespecially those that are implemented in work environments, lead to the acquisition of qualifications or part of them, which will have an impact not only at national level but also at European and global level.

Continuing, we must highlight the adjustments that must be designed, so that VET is not only more attractive but also more functional, providing a solution to the problem of early school leaving. The organisation of short-term training periods, which takes advantage of working environments and combines flexibility and efficiency, leads to the development of highly skilled workers who maintain their contact with the labour market and the ability to adapt to circumstances. The recognition of the knowledge and skills acquired through the use of micro-credentials is a way of building a modern professional profile, which a student can manage and enrich through specific training activities.

THE ECVET CREDIT SYSTEM

The 2002 Copenhagen Treaty provided for the development of a system of credit units in VET to promote transparency, comparability, transferability and recognition of qualifications between EU countries and different levels of education. After a painstaking effort by many working groups in all member states, the ECVET system was developed which aimed to support student mobility and develop trust and collaboration between VET providers in the EU.

2012

Until 2012 there was a preparatory period during which Member States took steps to integrate ECVET into their national VET systems.

From 2012 to 2014, Member States integrated it.

2012-14

2014

2014 was a milestone as the evaluation and conclusions were planned, which would be incorporated into a new European Commission Recommendation on the implementation and operation of the system.

12.1

At the same time, structures were put in place to facilitate the implementation of the system and its subsequent development and adaptation to meet the needs for which it was created. Such structures were:

- The ECVET European Network was an open forum involving organisations, social partners, market representatives and VET providers. Its purpose was to spread the idea and exchange information and experiences among stakeholders.

- The European ECVET User Group. This political structure was attended by representatives of the Member States, the social partners, CEDEFOP and was intended to monitor ECVET policies in the Member States.

- The ECVET support team. This structure constituted a support group to the system, which had a consultative status in relation to the activities of the ECVET European Network.

But let's proceed with the organization of the system, to know its special characteristics, which will help us to understand possibly the reasons why it did not serve the objectives for which it was designed.

What were the main features of the ECVET system?

ECVET is a system of credit units that is based on the analysis of qualifications into groups that constitute sets of learning outcomes. Groups of learning outcomes correspond to parts of qualifications and include knowledge, skills and competences, which are assessed and validated. Groups of learning outcomes correspond to units of credit, which are calculated based on the assumed time required to complete the learning process and the workload required.

By earning credits gradually, the student can acquire a grade.The system could operate both nationally and transnationally, taking advantage of the mobility of apprentices and workers. The aim of the system was to regulate the interaction between VET providers operating in different contexts and to enable the integration of knowledge skills and competences acquired through non-formal and informal learning. To meet the objective, mechanisms for the accumulation, validation and recognition of qualifications had to be developed.

The implementation of the system in Europe with great diversity in relation to the organisation of VET and recognition of qualifications systems was risky. For the implementation of the system, the bodies involved in training, the awarding of qualifications and evaluation should work together on the basis of commitments regarding the time sequence of important actions and quality assurance, so that all stages are reached on time and valid documents are produced that the learner can manage flexibly and reliably.

What are the main documents of the ECVET system?

The main document created to establish a relationship between two or more parties involved in the design of an educational process within the system is the Memorandum of Understanding (MoU). It is a relationship mapping initiative and outlines an overall framework for cooperation between the parties involved. The second step is the development of the Learning Agreement (LA), which contains many elements in relation to the expected learning outcomes, but also the form of assessment, validation and finally recognition of the Qualification or part of it. Finally, the learning outcomes obtained, as well as the credits awarded, are recorded in the Transcript of Records, which is a certificate of successful completion of the training process.

MEMORANDUM OF UNDERSTANDING

In the context of the European Credit System for Vocational Education and Training (ECVET), a memorandum of understanding refers to a non-binding agreement between two or more parties outlining their intentions, objectives and commitments with regard to the implementation and operation of the ECVET system.

The ECVET system is designed to improve the recognition, validation and transferability of learning outcomes in different countries and vocational education and training (VET) systems within the European Union (EU). It aims to promote mobility and facilitate people's lifelong learning by ensuring that their skills and qualifications acquired in one country can be recognised and valued in another.

The memorandum of understanding generally covers the following aspects:

- **Purpose and scope:** Defines the purpose and scope of the agreement, indicating the intention to implement and support the ECVET system.
- **Roles and responsibilities**: It clarifies the roles and responsibilities of each party involved, describing their obligations in the implementation of ECVET, such as developing and evaluating learning outcomes, providing appropriate support and guidance, and ensuring transparency and quality assurance.
- **Learning Outcomes and Units:** Describes how participating parties will identify, describe and assign credit points to learning outcomes and units within the ECVET system. This includes defining the competences, skills and knowledge that learners need to acquire and the criteria for assessing and validating these results.
- **Transfer and accumulation of credits:** Specifies the mechanisms and procedures for transferring and accumulating credits between participating VET systems. This includes agreements on credit conversion, recognition of prior learning, and documentation and certification processes.
- **Quality assurance:** Establishes procedures to ensure the quality and reliability of ECVET implementation. This may involve monitoring, evaluation and review mechanisms, as well as cooperation in external quality assurance activities.

- **Support services:** Describes the provision of support services, such as guidance, counselling and information, to learners, trainers and other stakeholders involved in the ECVET process.

- **Duration and Review**: Sets out the duration of the memorandum of understanding and provides provisions for periodic reviews, updates, and amendments to reflect changes in the ECVET system or the circumstances of the participating parties.

It is important to note that a memorandum of understanding is not a legally binding document, but rather serves as a commitment and framework for cooperation and coordination between the parties involved in the implementation of the ECVET system.

LEARNING AGREEMENT

The Learning Agreement is a document that outlines the agreed learning outcomes, assessment methods, and credit transfer agreements between the sending and receiving organizations involved in a mobility experience.

The Learning Agreement is an essential tool used to facilitate the recognition and validation of learning outcomes achieved during a period of mobility within the ECVET system. It ensures transparency and mutual understanding between the learner, the sending organisation and the hosting organisation.

The key elements that are typically included in a Learning Agreement are as follows:

- **Personal and Contact Information:** Personal data and contact information of the learner, as well as details of sending and receiving organizations.

- **Duration and location of the mobility:** The start and end dates of the mobility period, along with the location of the receiving organization.

- **Description of learning outcomes:** A clear description of the expected learning outcomes to be achieved by the learner during the mobility period. These results are usually aligned with the overall grade or program requirements. The learning outcomes should be described in detail and listed as an annex to the main document.

- **Credit Allocation:** Agreed-upon credits will be awarded upon successful completion of learning outcomes. The allocation of credits should be described in detail and is listed as an annex to the main document. The home organization must decide the maximum credits to be awarded for each group of learning outcomes and how the credits will be calculated after the learner's assessment.

- **Assessment Methods:** The assessment methods and criteria that will be used to assess the learner's achievement of the expected learning outcomes. This may include exams, practical assessments, project work, or any other appropriate method.

- **Recognition and transfer of credits**: The procedures and criteria for recognizing and transferring credits earned by the student from the receiving organization to the sending organization. This includes details about documentation, certification, and issuance of transcripts.

- **Support and guidance**: The support, guidance and tutoring services provided to the learner during the mobility period. This may include language support, cultural orientation, academic support, and any other relevant assistance.

- **Responsibilities and Obligations**: The roles, responsibilities and obligations of the learner, the sending organisation and the receiving organisation, including any additional requirements or conditions agreed upon.

- **Signatures and Approvals**: The signatures of the learner, the representative of the sending organization, and the representative of the receiving organization indicate their agreement and commitment to the terms described in the Learning Agreement.

The Learning Agreement serves as a reference and formal agreement between the parties involved, ensuring transparency and consistency in the recognition and transfer of credits within the ECVET system. It provides a clear framework for the learning experience, assessment procedures and credit transfer, improving the quality and recognition of vocational education and training across Europe.

TRANSCRIPT OF RECORDS

It is an official document that provides a comprehensive overview of a student's learning outcomes, credits, and grades. It serves as a detailed record of a student's educational achievements and facilitates the recognition and transferability of credits within the ECVET system.

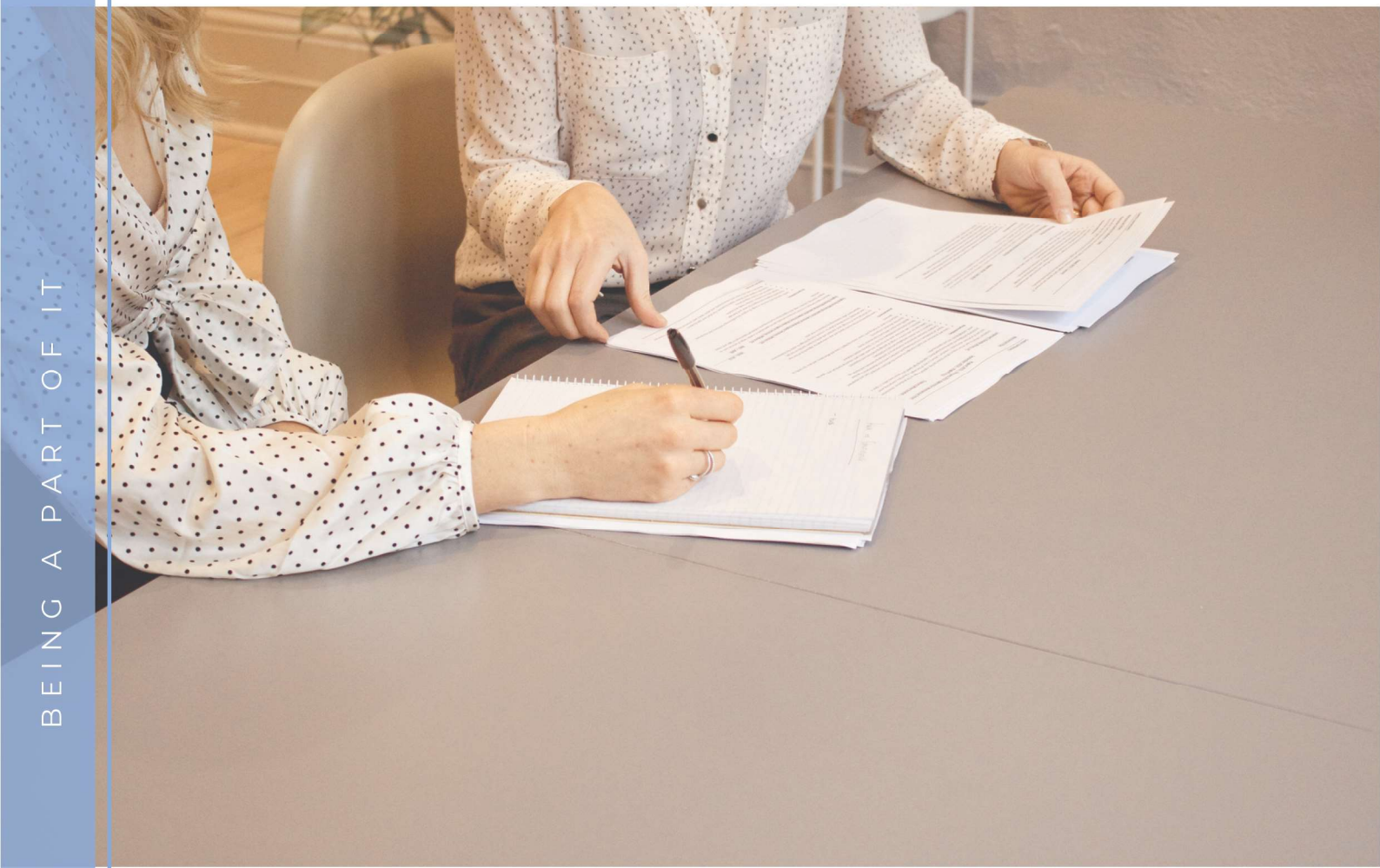
The transcript of records typically includes the following information:

- **Personal and Contact Information:** The student's personal data, including their name, date of birth, identification number, and contact information.
- **Qualification Information**: The qualification or program in which the student is enrolled, including the degree, level, and any majors or specializations pursued.
- **List of Learning Outcomes**: A detailed list of the learning outcomes achieved by the learner during their education or training. These results are usually aligned with the qualification requirements and include a description of the knowledge, skills and competences optionally acquired. Learning outcomes should be organized into units and sub-units to be in accordance with the Learning Agreement.
- **Credits:** The number of credits awarded for each learning outcome achieved. These credits represent the volume of learning and are used to measure and compare qualifications within the ECVET system.
- **Grade or Assessment Results:** The results of the assessment or grades obtained by the student for each learning outcome achieved. This provides an indication of the learner's performance and level of achievement.
- **Date and place of achievement**: The date and place where learning outcomes were achieved and evaluated. This helps establish the timeline and context of the learner's educational journey.
- **Recognition and Transfer Information**: Details about the recognition and transfer of credits earned by the learner, including any agreements or arrangements between sending and receiving organizations. This may include information about credit conversion, validation of prior learning, and any specific procedures followed.

- **Certification and authorization:** The certification and authorization information, including the signatures and seals of the relevant authorities or responsible persons of the issuing organization. This ensures the authenticity and official recognition of the transcription of records.

- **General information on the calculation of the credits** that have been awarded to the student and the context, so that the document is more understandable for any potential recipient.

Record transcription serves as an essential document for students, educational institutions, and employers. It allows students to showcase their educational achievements and facilitates their mobility and career progression within the ECVET system. Educational institutions use Record Transcription to assess credit transfer and recognize prior learning, while employers may refer to it to assess a candidate's qualifications and competences.



EUROPASS

Europass offers students, workers and job seekers a variety of online tools to enable them to manage and present their training and career in Europe.

Among the main tools are the Europass profile, the CV and cover letter editor, the European Diploma Supplement (document containing all the information on the knowledge acquired in higher education), the Europass Certificate Supplement (document containing all the information on the knowledge acquired in VET) and the Europass Mobility Document.

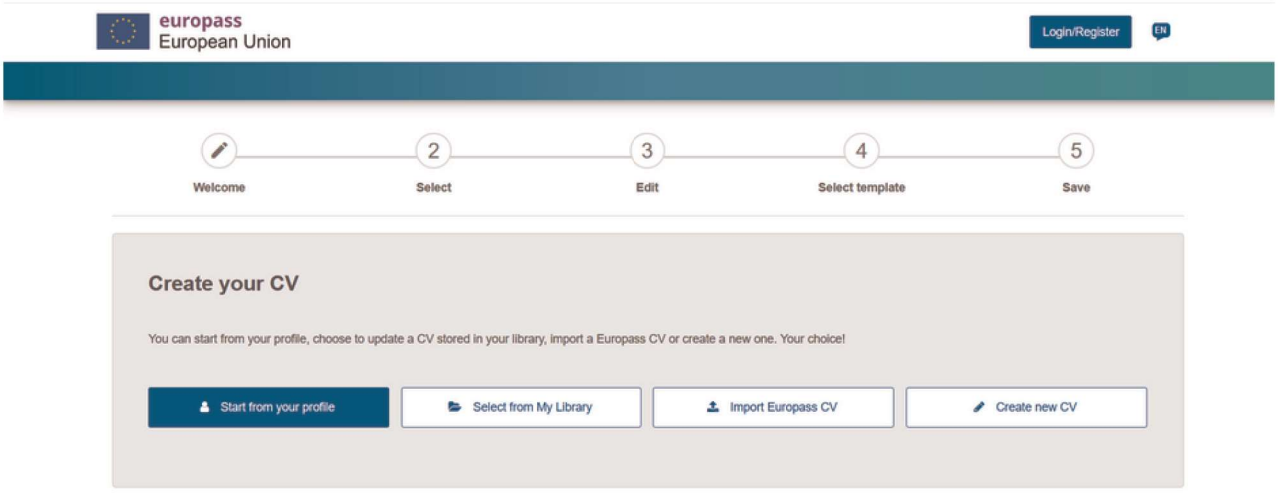
CV EUROPASS

The Europass service offers the possibility of creating your own online CV with one of the most widely used and recognised formats in Europe by companies. In addition, Europass allows you to create, store and share your CV in 30 languages, making it easier to find a job.
This is a very important tool for students, as it will allow them to show all the training and experience they have, including the period of practical training in the classroom with the BPI methodology.

How to create a CV on Europass?

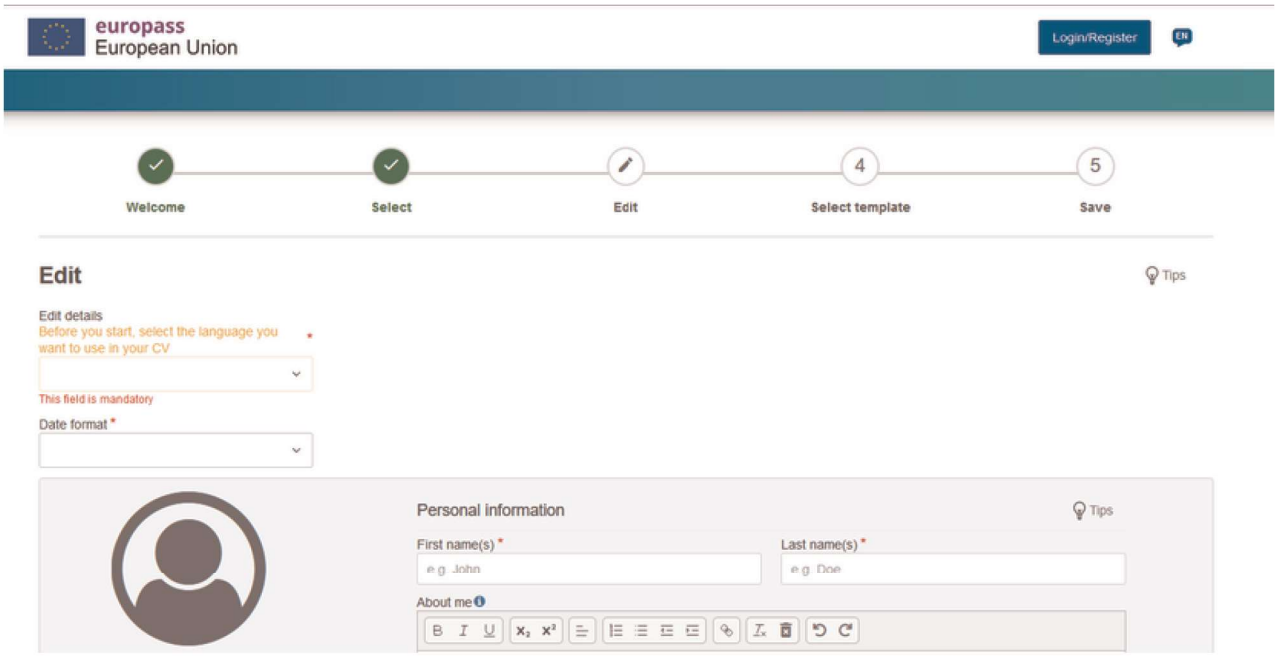
Step 1. Go to your personal profile. From the main profile page, users can access their CV creation "Create a CV" in the left sidebar.

Step 2. Europass allows you to choose between four options: start by creating a CV from the profile information, select a CV from the Europass library, import a Europasss CV or create one from scratch.



From the first option, they will access the personal profile, from where they can select all the information they want to appear on the CV and/or edit it. Secondly, they will choose the most suitable template and, finally, they will be able to download it, save it in their Europass library or publish it directly on EURES (EURopean Employment Services, a platform for job and worker search at European level).

From the last option (Create new CV, they will access a resume editor that will allow them to include all personal, professional and educational information.



How does ECVET connect to Europass?

Europass, as described above, is another tool that can be part of the ECVET system. The Europass has individual elements that can support pupils in their educational and professional development. Of the set of individual tools available in the Europass suite, one of those related to the registration of knowledge and skills and can complement ECVET, as well as be used with the use of the BIS methodology, is the Europass Certificate Supplement.

The Europass Certificate Supplement is awarded to persons who have a certificate of completion and have already obtained a qualification. This specific tool allows a detailed description of the knowledge, skills and abilities that natural persons possess through VET. This is a structured and formalized document, which is officially issued by a VET provider.

This document could complement the system to describe in more detail the knowledge and skills acquired through the learning process, especially when it comes to non-formal and informal education providers.

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MICROCREDENTIALS

Micro-credentials have been seen as the new hot topic in the provision and recognition of skills. They are not new to education. They have been used in many sectors to demonstrate the acquisition of sectoral skills in labour market demand or in specific sectors to provide flexible tools to provide employees with the qualifications that have been deemed appropriate to ensure that they can adapt to modern labour market conditions. Ireland has been using micro-credentials for more than 20 years. In recent years, micro-credentials have become more attractive to public and private stakeholders and are more popular in general education, VET and higher education.

It is very important to start analysing this tool taking into account the definition proposed by the EU.

A micro-credential is proof of the learning outcomes that the learner has acquired after a brief learning experience. These learning outcomes have been assessed against transparent standards. The test is contained in a certified document listing the name of the holder obtained, the learning outcomes, the assessment method, the awarding body and, where applicable, the level of the Qualifications Framework and the credits obtained.

12.3

Micro-credentials are student-owned, shareable, portable, and can be combined into larger credentials or grades. They are backed by quality assurance following agreed standards.

We find micro-credentials in various types that are called "Micro-Certifications", "Badges", "Micro-Qualifications", "Supplemental Qualifications", etc.

As micro-credentials become increasingly popular in the EU and beyond, it is interesting to study how some countries have developed the environment for their proliferation.

Some countries, such as the Netherlands and Norway, consider micro-credentials as part of the formal VET system. In Sweden, the consortium of organisations responsible for skills development and employment has been working on the description, quality control, recognition, stacking and portability of micro-credentials. Spain has also developed many micro-credentials in the context of the new VET law. Estonia and Croatia have developed new legislation regulating the acquisition of micro-credentials in adult VET programmes. Ireland appears to be the first to establish official pathways to provide micro-credentials from universities for Level 6 students (EQFs) and later for VET students. The food sector, as well as in Ireland, demonstrates the widespread implementation of micro-credentials for skills deemed suitable for employment. It is very interesting to focus on the definition given by the Irish Qualification Authority for micro-credentials. To them, a micro-credential is a qualification that attests to a small-volume, highly specific learning achievement. It's more or less a working definition that sets things in motion regarding the content, usefulness of micro-credentials, as well as their impact on students' educational and professional profiles.

Germany and France have facilitated the introduction of short-term VET programmes that provide flexible ways to help people adapt to the work environment and meet their demands.

In the Netherlands, organizations can issue online micro-credentials that are called edubadges. Recipients can store and share them with employers or higher education providers to demonstrate their skills and qualifications. Stakeholders from the public and private sectors can authenticate badges. The role of the portal in the Netherlands is very interesting, as it is seen as the tools to address the shortage of skilled workers. Micro-credentials have been seen as a useful tool for the integration of refugees into the economy and society. Refugees with various types of qualifications from their countries can attend short-term programs to update their educational and professional profile or simply to obtain a credential that makes them more acceptable as skilled workers in the labor market.

What are the main characteristics of micro-credentials that make them so important in modern education and the job market?

The modern labour market is increasingly affected by the development of new technologies that penetrate all sectors of the economy and shape a new environment in which retraining and upskilling are essential for workers and determine the degree to which they adapt to new requirements. as they are expressed from the employers' side in the form of knowledge, but mainly as skills and competences.

The modern labour market is increasingly affected by the development of new technologies that penetrate all sectors of the economy and shape a new environment in which upskilling is essential for workers and determines to a large extent the degree to which their adaptation is adapted to new requirements such as these, which are expressed from the employer's side in the form of knowledge. but mainly skills.

People, whether they are already in the job market or about to enter it, need to be able to use new technology products and learn new techniques that help them ensure a secure career. People need to be prepared to meet the demands of a rapidly evolving labor market that incorporates technology products at a very rapid pace.

> *The educational and professional profile of young and older workers needs to be changed regularly in order to be competitive, but also to support the sustainability of the companies they work for.*

Microcredentials can be particularly useful in areas that are not covered by qualifications, such as those earned through formal education for various reasons. For example, qualifications acquired through formal education may not include knowledge and skills for a long time because they are simply not included in the skills package, either because they did not attract interest or because the technology has not been developed accordingly.

Companies take a more active role in employee training in an effort to ensure the development of a workforce with higher skills, develop education and training activities independently or in collaboration with certified educational institutions with the aim of providing up-to-date knowledge to employees or those who wish to work for them.

In the modern era, learning takes on a more flexible relationship with space and time. Distance education is gaining more and more interest, especially for people who are bound by professional obligations and cannot participate in traditional educational schemes to enrich their professional and educational profiles. We experienced a similar example during the pandemic period where traditional educational schemes stopped working, but people's needs to evolve did not stop. The public and private sectors worked to create educational pathways that could fill the gap and give people the opportunity to develop.

Micro-credentials can meet the needs of stakeholders by designing flexible schemes to provide up-to-date knowledge and skills through short training programs that can be implemented completely remotely or through a combination of educational methodologies. The flexibility of the methodology also affects the cost of training, making it more accessible to people who have limited incomes or are experiencing difficulties.

The educational and professional profile of young and older workers needs to be changed regularly in order to be competitive, but also to support the sustainability of the companies they work for.

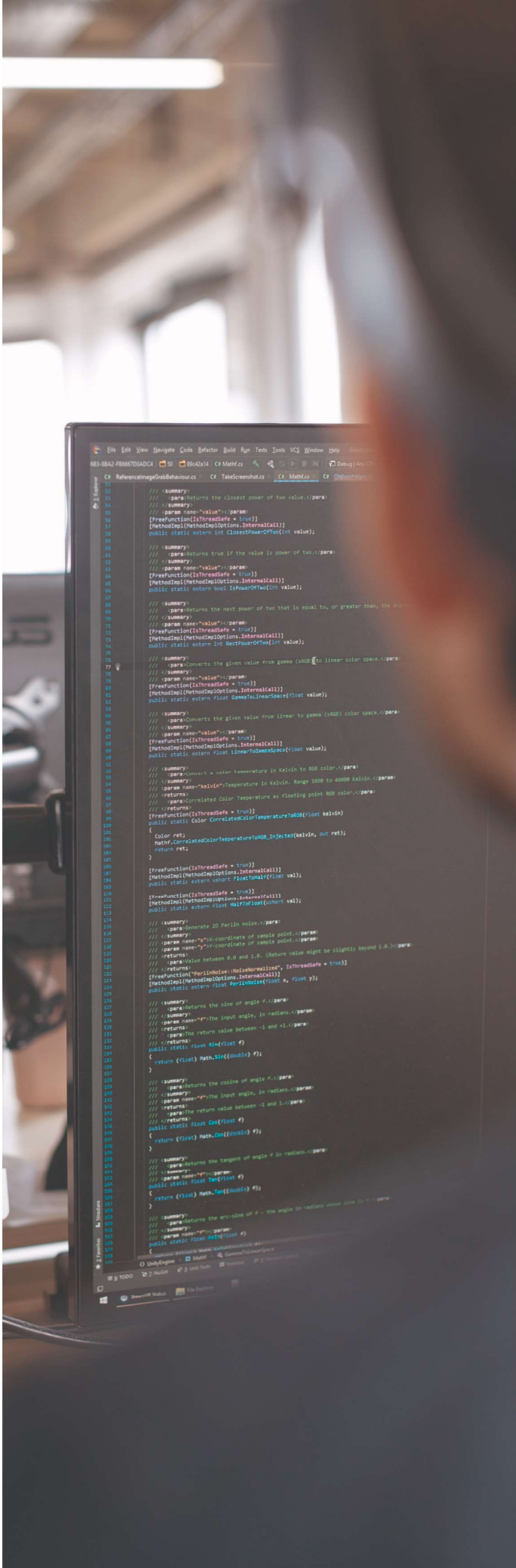
Through flexible educational schemes, people have the possibility to cope with the pressure they feel in their careers due to the increasing demands for the application of digital technology, changes in the organization of work and the aging of the population.

It is very important to emphasize that, if the implementation of such flexible schemes works exclusively in the context of private sector activities, then it will be very stressful for people who experience difficulties in joining them and maintaining an educational and professional profile that could keep them active in the labor market.

What are the factors that limit the implementation of microcredentials?

The debate on the application and use of micro-credentials is very long and concerns very specific areas, some of which have already been mentioned in previous sections.

The provision of a large number of micro-credentials by educational and professional bodies raises questions about the value, but also about the processes followed for their performance. Lack of transparency is a major problem and has a major impact on the value of the securities offered. At this point, the interconnection of micro-credentials with the national qualifications framework should also be considered. Micro-credentials, and especially those issued by private bodies, are not compatible with all national qualifications frameworks. As well as all national qualifications frameworks do not accept micro-credentials for the award of a qualification. Therefore, we easily come to the conclusion that the collection of micro-credentials for the granting of a qualification is not an easy path, as it is necessary to define the criteria on the basis of which they are awarded and the regulatory role of the education authorities.



Micro-credentials and their relationship to the qualification system

The association of micro-credentials with the European or national qualifications framework opens up a great deal of debate on the dynamics and the role they play in relation to a framework which, while having the task of delineating the issues relating to the way qualifications are obtained and the functionality of qualifications in education, but also at work,it is essentially complemented or undermined by a process that evolves in parallel and creates new data that should be governed exclusively by the qualifications framework.

The development of many micro-credentials that distort the overall path of qualification development creates the feeling that outside of the formal process there is another route through which one can arrive at the development of a set of skills that can make it fully competitive, offering employment opportunities in particular in the case where micro-credentials are provided by private educators or professional bodies. This raises a number of questions about the usefulness of the qualifications framework and the reliability of formal education pathways.

The acquisition of qualifications through the formal process is not only vocationally trained, but has social, political and historical ramifications that are considered important for a large part of society that is unwilling to accept alternative educational pathways that replace or complement those traditionally used to obtain certain qualifications.

The impact on society of alternative educational pathways raises questions about the usefulness, purpose and effect on the evolution of traditional structures for educational and professional development that have emerged as pillars of well-being and social cohesion, but also of technological and economic development.

The acquisition of a qualification through the structures of formal education guarantees the content of the training, but also the processes of evaluation of the learners for the performance of the qualification. In countries where the connection between formal education and the workplace is important, the tasks within the framework of formal education are such as ensuring the adequacy of qualifications, as its structure based on the requested learning outcomes meets the needs of the labour market without creating problems in the smooth transition of people from the field of education to work.

Modularity

The development of micro-credentials creates a lot of confusion regarding the reliability and validity of qualifications obtained through education and training and, in some cases, also through higher education. The modular structure of qualifications raises questions, but it also appears to be a basic condition for the integration of micro-credentials into qualifications. However, the development of mechanisms through which the learning outcomes obtained from non-formal and informal education schemes can be validated and recognized.

In many European countries, qualifications frameworks are distinguished from a holistic approach to include qualifications acquired through alternative forms of learning. The topic becomes more interesting as the number of micro-credentials grows, which are developed by bodies that do not operate within the framework of the formal educational process, and the guarantees they provide in relation to quality and qualification processes are questionable.

The use of the credit unit system within the framework of the modular qualifications structure provides for the possibility of accumulating credit units and the corresponding qualifications corresponding to them. At this point, it should be noted that micro-credentials obtained through participation in training activities in work environments in which no formal education organization participates, cannot be used for the accumulation of credits and qualifications or used in the context of formal education.

TO ACHIEVE THE INTEGRATION OF MICRO-CREDENTIALS into qualification recognition processes:

- The quality of activities must be ensured.
- The development of learning outcomes, as well as the process of assessing learners, should be described in detail.
- An operating system of credit units should be developed.

Microcredit has the ability to provide a flexible solution tailored to the needs of the labour market through which it is ensured that an individual has achieved specific learning outcomes. However, they cannot be compared in validity and reliability to certificates that are issued through formal education and that are milestones in one's educational journey.

For this reason, micro-credentials seem to have greater utility in helping people respond to technological developments that are in high demand by the workplace. They seem to be useful for the planning of short periods of training in specific fields according to the preferences of the apprentices themselves and are related to the field of work in which they intend to be employed, but also to the shortcomings that they themselves find they have in relation to the needs of the labour market and are due to the slow response of formal education to technological developments and the demands of the education. labour market. In either case, the organization providing the micro-credential determines its quality and acceptance.

Micro-credentials design

Effective micro-credential strategies encompass two important aspects: designing learning experiences and effectively communicating the outcomes of these experiences. Digital badges serve as a frequent method of presenting and sharing micro-credential achievements. While digital badges are commonly perceived as mere graphics, it is the digital metadata associated with these badges that truly describes the learning achievement and enriches its importance (Open Badges). Not only does this help people understand and express their learning achievements more effectively, but it also allows for the translation of this data into a machine-readable format. Consequently, this further expands the scope and value of the micro-credential.

To harness the potential of connecting learning and work through micro-credentials and digital badges, a deliberate strategy and design process are crucial.

Achieving successful micro-credentials involves addressing several key design features:

- **The need:** Are the knowledge, skills, and abilities encompassed in the micro-credential significant in the market?
- **The value:** What benefits does the microcredential offer to people (time savings, cost savings/increases, risk mitigation, recognition, etc.)?
- **Validation:** What evidence is used to demonstrate the acquisition of competences?

The concept of micro-credential design involves addressing fundamental questions such as:

- **Target Audience:** Who is the target audience for the micro-credential?
- **Drivers:** What is the motivation behind the creation of the micro-credential?
- **Value proposition:** What value does the micro-credential bring to people?
- **Offer:** How will the micro-credential be packaged and delivered?
- **Competences:** What knowledge, skills, and abilities make up the micro-credential?
- **Name:** What should the micro-credential be called?

These conceptual factors must be individually strong and at the same time designed to complement each other. For example, the name of the micro-credential should be easily understood by the intended audience and convey the composition of the competences.

Micro-credentials are also deliberately structured. The structure shows the relationship between competences, learning evidence, and the digital badge. It also outlines the rules and requirements needed to complete the micro-credential and earn the digital badge.

The conceptual and structural designs of micro-credentials work together to establish a framework for success. This structure also aligns with the evidence of learning. For example, simply attending a seminar would not adhere to this model, while attending a seminar and developing a reflection or project as evidence of learning would align with the verified micro-credentials model.

KEY ELEMENTS IN MICRO-CREDENTIAL DESIGN

SPONSOR

The sponsor initiates the micro-credential concept and assumes ownership once it is available to students. This could be a school, academy, institute, or any entity that offers the micro-credential. The sponsor also sets the public brand for the micro-credential and digital badge.

DEISGN TEAM

The design team facilitates the strategy and design of the micro-credential. They model competences, ensure alignment between competences and evidence, and validate design according to industry standards and trends.

CONTENT & INDUSTRY EXPERTS

These experts provide guidance and make decisions regarding the knowledge, skills, and abilities to be included in the micro-credential, leveraging their expertise in the respective content area or industry.

VERIFIER

Once an individual has created evidence of learning for the microcredential, the verifier evaluates the evidence according to established requirements and standards. They verify that the person has successfully demonstrated the specified competences through evidence of learning.

EMITTER

The issuer receives verification decisions for the micro-credential and issues the appropriate digital badge to the employee. They are responsible for ensuring accuracy throughout the issuance process and following the correct procedures for each digital badge award.

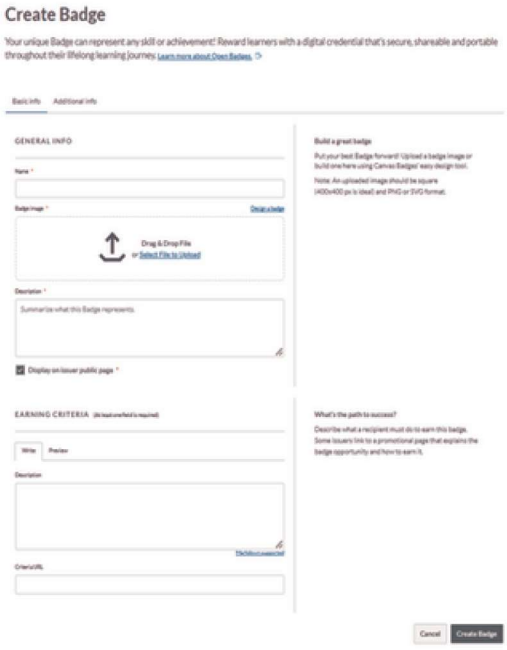
How does the student get involved?

- The learner engages in discovery, gathers information, and develops a clear understanding of the micro-credential value proposition.
- The student selects the micro-credential(s) of interest and decides to enroll.
- The learner enrolls with a comprehensive understanding of his/her commitment, including effort, time, obligations, benefits, costs, and terms and conditions.
- The learner begins the micro-credential course, receiving support and ideally having access to a learner dashboard to track progress and stay motivated.
- The student takes the micro-credential assessment, submits any required evidence, and receives timely recognition and notification of results and grade.
- The learner claims his/her digital badge or other digital certification, and his/her achievement is recognized and celebrated.
- You post and share the badge, and you are encouraged to enroll in new credentials, encouraging continued learning and growth.

Technology for the issuance of micro-credentials

Institutions are faced with technology decisions based on how they create, distribute, manage, and issue micro-credentials. Adopting an open system architecture requires full interoperability between various systems, platforms, and composite applications. These include a learning management system or equivalent, an issuance platform, and a student/alumni management system that records transactions. Integration with user authentication, identity management, and data security systems is crucial. In addition, a system of record is necessary to track and manage the lifecycle of micro-credentials. While existing platforms support formal education, they require modifications to accommodate new accreditation models, course designs, and support for diverse students. Institutions must choose between building custom in-house software or partnering with vendors that offer appropriate technology and services, such as outsourcing the identification platform or issuing digital credentials.

When designing a digital badge, it's crucial to consider the intended audience, which is usually external to the issuing organization. The badge should be designed to benefit this audience while remaining identifiable to the issuer. It should reflect the branding of the issuing organization, taking into account factors such as shape, color, font, and iconography. However, these design elements should align with the brand's institutional guidelines and contribute positively to the impact of the badge.



The badge design can also represent the taxonomy or structure of the micro-credential portfolio, indicating skills, competences, proficiency levels, or industry associations. While the badge serves as an image, it's more than that. It's a smart digital artifact with embedded metadata, which is the real potential of digital credentials. Metadata accurately describes and defines the microcredential, and adherence to metadata standards ensures its acceptance within the ecosystem. Metadata provides information about how the credential was earned, who issued it, winner verification, and other details related to industry recognition.

BLOCKCHAIN CREDENTIALS

Blockchain-anchored credentials, also known as blockchain-based credentials or blockchain-backed credentials, are digital credentials that use blockchain technology to enhance their security, integrity, and portability. These credentials leverage the decentralized and immutable nature of blockchain to provide a trusted, tamper-proof method for verifying and sharing achievements, qualifications, and certifications.

Traditionally, credentials and certificates have been issued and stored in centralized systems, making them vulnerable to fraud, forgery, and loss. Blockchain technology addresses these challenges by offering a transparent, decentralized, and tamper-resistant infrastructure for issuing, verifying, and storing credentials.

Issuing blockchain-anchored credentials involves several steps. First, the issuer, such as an educational institution or certification body, creates a digital credential that represents achievement or qualification. This credential is hashed, which means it becomes a unique alphanumeric string that serves as your fingerprint.

The hashed credential, along with additional metadata such as issuer information, recipient details, and date of issuance, is recorded on the blockchain. This creates a permanent and verifiable record of the credential, making it tamper-proof and easily auditable. The decentralized nature of the blockchain ensures that multiple copies of the ledger exist throughout the network, further enhancing the security and reliability of the credential.

Once the credential is anchored to the blockchain, it can be easily verified by anyone with access to the blockchain network.
Blockchain-anchored credentials offer several advantages over traditional credentials. First of all, they provide greater security and trust as they are protected by the cryptographic properties of the blockchain. The decentralized nature of the blockchain eliminates the need to rely on a single authority, reducing the risk of fraud and tampering.

They are portable and interoperable. Since they are stored on the blockchain, people can access and share their credentials with others securely and seamlessly. This eliminates the need for physical documents or central databases, streamlining the verification process and reducing administrative burdens.

In addition, they allow people to have greater ownership and control over their accomplishments. With traditional credentials, people often rely on intermediaries or institutions to verify and validate their qualifications. In a blockchain-based system, people can directly submit their credentials for verification, empowering them with a self-sovereign identity and reducing reliance on third parties.

Despite their numerous benefits, blockchain-anchored credentials still face certain challenges. A major hurdle is the need for widespread adoption and interoperability across different blockchain networks and systems. Efforts are underway to develop standards and protocols that allow for seamless integration and verification of credentials across various platforms.

In addition, reliance on blockchain technology requires technical literacy and infrastructure. Individuals and organizations must have access to blockchain networks and appropriate tools to create, issue, and verify blockchain-anchored credentials. However, as blockchain technology continues to evolve and become more accessible, these barriers are gradually being addressed.

In conclusion, blockchain-anchored credentials offer a promising solution for secure and reliable verification of achievements and qualifications.

EU'S INITIATIVES ON BLOCKCHAIN CREDENTIALS

The European Union (EU) has recognized the potential of blockchain technology in the field of credentials and has initiated several efforts to explore its application and promote its adoption. Some key EU initiatives related to blockchain credentials are:

European Blockchain Services Infrastructure (EBSI)

The EBSI is a collaborative project that aims to establish a European blockchain infrastructure for public services. It provides a secure and reliable platform for the issuance, verification, and administration of various types of digital credentials, including educational diplomas, professional qualifications, and licenses. The EBSI facilitates interoperability between different EU member states and improves the security and efficiency of accreditation processes.

European Blockchain Partnership (EBP)

The EBP is an initiative launched by the EU in collaboration with several member states. It aims to establish a European Blockchain Services Infrastructure (EBSI) and promote the adoption of blockchain technology in various sectors, including education and credentialing. The partnership focuses on creating common standards, frameworks, and guidelines to enable the seamless exchange and recognition of blockchain-based credentials across Europe.

European Blockchain Pre-Commercial Procurement (PCP)

The European Blockchain PCP is a program that supports the development and deployment of innovative blockchain solutions for public services. One of its areas of focus is the verification and validation of educational and professional credentials using blockchain technology. The program fosters collaboration between public authorities, research institutions, and industry stakeholders to explore the potential of blockchain credentials and accelerate their adoption in the European market.

European Blockchain Observatory and Forum

The European Blockchain Observatory and Forum, established by the European Commission, serves as a knowledge hub and platform for dialogue on blockchain-related topics. It monitors blockchain developments, conducts research, and publishes reports on various applications of blockchain technology, including credentials. The observatory aims to facilitate knowledge sharing, collaboration, and awareness of blockchain initiatives within the EU.

Digital Education Action Plan

The EU Digital Education Action Plan emphasises the importance of digital skills and lifelong learning. It recognises the potential of blockchain technology to improve the recognition and validation of skills and qualifications. The plan encourages the exploration and piloting of blockchain-based solutions for credentials and supports initiatives that promote the interoperability and portability of digital credentials in educational institutions and labor markets.

These EU initiatives reflect the EU's commitment to leverage blockchain technology to improve accreditation processes, increase trust and enable the secure and verifiable recognition of qualifications across Europe. By fostering collaboration, standardization and innovation, these initiatives aim to accelerate the adoption of blockchain credentials and contribute to the digital transformation of the education and employment sectors within the EU.

What is the EBSI Diploma Platform?

The EBSI Diploma refers to a digital credential issued through the European Blockchain Services Infrastructure (EBSI). EBSI is a European Union (EU) initiative aimed at using blockchain technology for secure and verifiable transactions and digital services. The EBSI Diploma leverages this infrastructure to provide a reliable and tamper-proof digital representation of educational achievement.

The EBSI Diploma serves as a digital version of a traditional paper diploma or certificate, but with additional benefits and features enabled by blockchain technology. It aims to improve the portability, security and recognition of educational qualifications across Europe and beyond.

The EBSI Diploma is part of the EU's wider efforts to promote the digitalisation of credentials and facilitate lifelong learning. It aims to simplify credential verification processes, reduce administrative burdens and improve the recognition of qualifications in a rapidly evolving digital world. By leveraging blockchain technology, the EBSI Diploma provides a secure and transparent solution for individuals, employers, and educational institutions to effectively manage and validate educational achievement.

It is important to note that the specific implementation and details of the EBSI Diploma may vary, as the initiative is still in its development and implementation phases. Therefore, it is advisable to consult official sources and relevant educational institutions for the most up-to-date and accurate information about the EBSI Diploma.

Way to anchor a credential to the blockchain

The path that describes the issuance path involves a series of steps and components to ensure transparency, integrity, and verifiability. Here's an overview of the key aspects for designing a credential:

Issuer identification	The credential design should prominently display the name, logo, and contact information of the issuing organization or institution. This establishes the credibility and authority of the issuer.
Credential details	The blockchain credential should include specific information about the credential, such as the title, description, issue date, expiration date (if applicable), and any relevant metadata. This information helps people understand the purpose and scope of the credential.
Unique identifier	Each blockchain credential must have a unique identifier or hash value associated with it. This identifier serves as a reference point for verification purposes and enables traceability within the blockchain network.
Credential Description	A detailed description of the credential should be included, describing the competences or skills acquired, the evaluation criteria used, and any relevant standards or frameworks associated with the credential. This provides a clear understanding of what the credential means.

Broadcast path	The design should incorporate a visual representation or description of the broadcast path. This could include information about the steps involved in the accreditation process, such as enrollment, completion of assessments or courses, verification, and final issuance. The path should highlight the checkpoints where validation and verification occur.
Blockchain integration	The blockchain technology used for the credential should be mentioned, along with any blockchain-specific protocols, networks, or smart contracts employed. This information ensures transparency and allows people to access immutable records on the blockchain to verify the credential.
QR code or URL	The design of the credential should include a QR code or web URL that leads to a dedicated web page or platform for credential verification. This allows for easy access to the verification process, where people can scan the code or visit the URL to validate the credential.
Security features	To enhance the security of the blockchain credential, additional security features such as tamper-proof seals, holograms, or watermarks can be incorporated. These features provide visual cues to identify authentic credentials and deter fraudulent activity.

Verification instructions	The design should include clear instructions on how to verify the blockchain credential, either by scanning the QR code, visiting the URL, or using a specific verification platform. This helps people navigate the verification process effectively.
Standard compliance	The design should adhere to standards and frameworks relevant to blockchain credentials, such as those outlined by the World Wide Web Consortium (W3C) or other accreditation bodies. Compliance with these standards ensures interoperability and compatibility with existing verification systems.

It's important to note that the design of a blockchain credential can vary depending on the specific use case, industry, or issuing organization. The above points provide a general framework for designing a blockchain credential that outlines the issuance path and emphasizes transparency and verifiability.

OTHER EU INITIATIVES TO SUPPORT THE CONNECTION BETWEEN VET AND BUSINESS

The EU has been working on the development of useful initiatives that will facilitate the match between labour market demands and the qualifications that students can obtain by participating in various training schemes.

Two of them are:

- ESCO (European Skills, Competences, Qualifications and Occupations)
- EAfA (European Alliance for Apprenticeships)

12.5

ESCO (European Skills, Competences, Qualifications and Occupations)

ESCO is a Europe 2020 initiative that has been developed by DG EMPL (Directorate-General for Employment, Social Affairs and Inclusion) in collaboration with the European Centre for the Development of Vocational Training (Cedefop)

.

ESCO (European Skills, Competences, Qualifications and Occupations) is a multilingual classification of skills, competences and occupations relevant to the EU labour market and education and training. It can be used by online platforms to match job seekers with jobs and suggest training to people who want to retrain or improve their skills.

ESCO provides job descriptions for 3008 jobs and 13,890 job-related competences in 28 languages (including all official EU languages, as well as Icelandic, Norwegian, Ukrainian and Arabic). Providing a 'common language' on professions and skills aims to enable labour mobility across Europe and a more integrated and efficient labour market.

New skills are required, people are changing professions and employers more frequently, and occupational and geographical mobility is increasing. Companies and education and training providers need accurate and up-to-date information on skills and credentials to effectively manage staff and solve skills shortages as online talent platforms are revolutionizing recruitment.

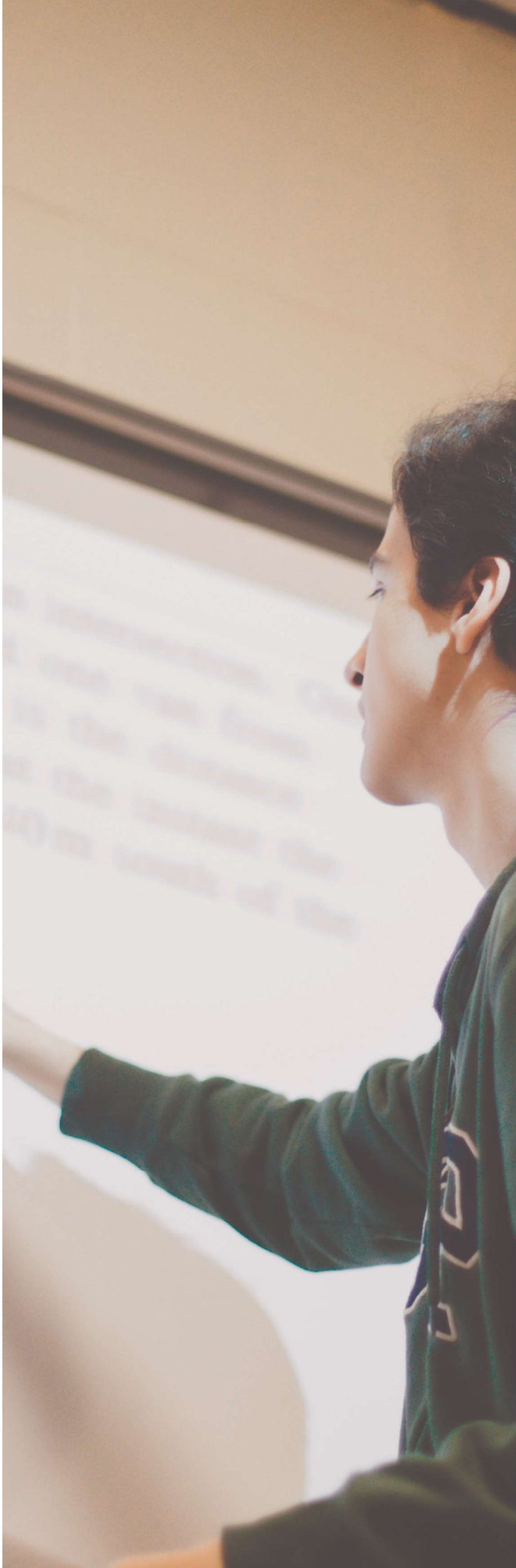
ESCO concepts and descriptions can help individuals understand the knowledge and skills required for a specific occupation, the knowledge, skills, and competences gained as a result of a specific qualification, and the qualifications required by employers. They can also ease the transition to the digital job market by offering a common language about occupations and skills.

ESCO's concepts and relationships can be understood by electronic systems, allowing them to suggest the most relevant jobs and training for job seekers.

ESCO provides accurate descriptions of occupations and skills to help employers and job seekers find the right jobs for their skills.

ESCO helps education and training providers understand the skills needed in the job markets and adapt their curricula accordingly to prepare students for future jobs. It also helps potential employers understand what students have learned.

ESCO is available in 28 languages, allowing job seekers and employers to better communicate about skills, training and jobs in any chosen European language. It is used on the EURES portal and other online platforms, helping European public and private employment services to offer their services across borders, languages and electronic systems. In order to remain an added value for the labour market and education and training systems, it is important to share comments, suggestions and proposals on how to improve the content and management of the classification with organisations using the ESCO and other ESCO stakeholders.



EAfA (European Alliance for Apprenticeships)

The European Alliance for Apprenticeships (EAfA) is an initiative launched by the European Union (EU) in 2013 to promote and improve the quality of apprenticeships across Europe. The main objective of EAfA is to improve the availability and attractiveness of learning opportunities for young people, as well as to strengthen the links between education, training and the labour market.

The initiative brings together various stakeholders, including public authorities, businesses, employers' associations, trade unions, chambers of commerce, vocational education and training providers and youth organisations. By fostering cooperation and collaboration between these partners, EAfA aims to facilitate the exchange of best practices, knowledge and experiences in the field of apprenticeships.

The key objectives of the European Alliance for Apprenticeships are:

- **Promoting Learning:** EAfA works to increase awareness and understanding of the value and benefits of apprenticeships as a pathway to employment and skills development. It encourages enterprises, in particular small and medium-sized enterprises (SMEs), to provide learning opportunities.

- **Improving the quality of apprenticeships:** EAfA supports the development and implementation of high-quality apprenticeship programmes by establishing common quality criteria and standards. It focuses on ensuring that apprenticeships provide relevant skills, knowledge and work experience, aligning them with labour market needs and national qualification frameworks.

- **Increasing learning mobility:** EAfA seeks to promote cross-border mobility and exchange opportunities for apprentices within the European Union. It fosters cooperation between Member States and the recognition of cross-border apprenticeships, enabling young people to gain valuable international experience and broaden their horizons.

- **Strengthening partnerships:** The initiative fosters partnerships between businesses, education and training providers, and other relevant stakeholders. These collaborations aim to improve the design, implementation, and monitoring of apprenticeship programs, making them more responsive to the changing demands of the labor market.

EAfA operates through a multi-stakeholder network that supports its goals. Network members commit to taking specific measures to promote apprenticeships, such as expanding the number of programmes offered or improving the quality of existing programmes. The European Commission provides guidance and resources to facilitate the exchange of good practices, policy development and monitoring of progress.

The European Alliance for Apprenticeships has helped to increase the availability and quality of apprenticeships across Europe. By promoting cooperation and sharing experiences, it strives to address youth unemployment, skills mismatch and promote lifelong learning opportunities.

CERTIFICATES

The simplest but most useful way to provide the learner with proof of participation in a training activity, whether in the context of an Erasmus+ project or not, is to award a certificate. The certificate is not just a piece of paper, but should contain the appropriate metadata that can be useful to any recipient and help them assess the owner's professional profile, as well as their willingness to participate in innovative activities that can have a significant impact on their career path. Many companies design training sessions for their staff to keep them in touch with new technologies and keep their staff consistent and strongly committed to the company's goals.

It is important for the company to realize that the staff maintains a modern attitude towards the qualifications necessary to achieve progress and success and is accustomed to participating in procedures that will lead to an up-to-date educational and technical profile.

12.6

ELEMENTS THAT A CERTIFICATE ISSUED BY THE HOST ENTITY MUST HAVE IN THE CONTEXT OF THE E+ PROGRAMME

- Name of the legal representative of the host body who will sign the certificate
- Host Organization
- Location of the host organization
- Shipping Organization
- Participant's Name
- Mobility period
- Program Code Number
- Program Title
- Host Organization Logo
- Erasmus+ logo

13

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14

ANNEX

Annex I. Memorandum of Understanding

Annex II. Learning Agreement

Annex III. Transcript of Records

Annex IV. Certificate of attendance

Annex V. Plan for adapting the didactic program to he BPI methodology by the IES ENRIQUE TIERNO GALVÁN (SPAIN).

MEMORANDUM OF UNDERSTANDING

Annex I

BEING A PART OF IT

Memorandum of Understanding

'File code' of the Memorandum of Understanding (optional)
text here

1. Objectives of the Memorandum of Understanding

The Memorandum of Understanding[1] (MoU) forms the framework for cooperation between the competent institutions. It aims to establish mutual trust between the partners. In this Memorandum of Understanding partner organisations mutually accept their respective criteria and procedures for quality assurance, assessment, validation and recognition of knowledge, skills and competence for the purpose of transferring credit.

Are other objectives agreed on? Please tick as appropriate	• No ☐ Yes – these are: please specify here

[1] *For more information and guidance on the establishment of a MoU please refer to the ECVET User's Guide: 'Using ECVET for geographical mobility (2012) - Part II of the ECVET Users' Guide - Revised version – including key points for quality assurance' – available at: http://www.ecvet-projects.eu/Documents/ECVET_Mobility_Web.pdf*

2. **Organisations signing the Memorandum of Understanding**	
Organisation 1	
Country	
Name of organisation	
Address	
Telephone/fax	
E-mail	
Website	
Contact person	
Telephone/fax	
E-mail	
Organisation 2	
Country	
Name of organisation	
Address	
Telephone/fax	
E-mail	
Website	
Contact person	
Telephone/fax	
E-mail	

3. Other organisations covered by this Memorandum of Understanding (if appropriate)

Explanatory note:

For MoUs established within a broader context (such as agreements set up by sector based organisations, chambers, regional or national authorities) a list of organisations (VET providers, companies, etc.) who are able to operate in the framework of the MoU can be added. This list can consist of their names or it can refer to the type of VET providers. The list can be included as an annex.

Company	Address	Contact Person	Tel / FAX	Email

4. The qualification(s) covered by this Memorandum of Understanding

Qualification 1	
Country	
Title of qualification	
EQF level (if appropriate)	
NQF level (if appropriate)	
Unit(s) of learning outcomes for the mobility phases (refer to enclosure in the annex, if applicable)	(See ANNEX1.2)
Enclosures in annex - please tick as appropriate	☐ Europass Certificate Supplement • The learning outcomes associated with the qualification • Description of the unit(s) of learning outcomes for the mobility ☐ Other:

5. Assessment, documentation, validation and recognition

By signing this Memorandum of Understanding we confirm that we have discussed the procedures for assessment, documentation, validation and recognition and agree on how it is done.

The assessment will be done as follows:

With an observation grid the company tutor (with the support and the supervision of the school/training centre's tutor) evaluates the mastery of the trainee and the capability to ensure an adequate standard of quality of expected results within the training/work process.

After an initial sharing of methodology and evaluation tools, using the observation grid, an initial training evaluation takes place at about the halfway of the path, to support the learning process of the participant.

An overall assessment will take place during the all internship (for details see the Learning Agreement).

Once the assessment is completed, the host Organization has to supply:

- The use of standardized assessment grids in which the assessors have recorded learners' performance.
- A written statement as a Personal transcript for every learner, concerning his/her personal achievements general progress, and what has been achieved fully or partially.

The home Organization will use the above documentation as a presumption for validation of learning outcomes.

Validation

Based on this evidence, the home Organization confirms, whether the learners has met the expectations (in terms of learning outcomes) and if so, the credit is validated.

The validation of the credit is according to the table listed in ANNEX 2.

6. Validity of this Memorandum of Understanding

This Memorandum of Understanding is valid until:

7. Signatures	

8. Additional information

Qualification: Computer Software Technician

Table 2	*Units Subunits and Learning outcomes of Computer Software Technicians*	
Units	**Subunits**	**Learning outcomes**
1. Software Installation and placement of peripheral devices	**1.1 Installation and initialization of the operating system**	**1.1.1.** Placement of the appropriate material in the computer so as to start the installation. **1.1.2.** Initiation of the operating system and installation of the basic settings. **1.1.3.** installation f the operating system (Microsoft office-Linux) **1.1.4** configures and adjusts the operating system **1.1.5** test the function of the operating system **1.1.6:** check for the proper operation of the operating system **1.1.7** documents the installation it performs **1.1.8** co-signs the relevant protocol
	1.2: Installation of the Software (Open office, Works, Open source application)	**1.2.1** Initiation of the existing operating system and placement of the basic installation settings. **1.2.2.** Customization, personalization and setting of the operating system so as to be ready for installation **1.2.3** Installation of the programs as following; • Text document • Spreadsheet

		• Presentation • Drawing • Database • Formula **1.2.4.** Test and verification of the proper function of programs installed. **1.2.5.** Validation of the programs' installation by subscribing the appropriate protocol 1.2.6 Test and check the proper operation of software installed 1.2.7 documents the installation it performs 1.2.8 co-signs the relevant protocol
	1.3: Installation of peripheral devices and their drivers	**1.3.1.** Receipt and unpack of the computer peripherals to be installed . **1.3.2.** Connection of the peripheral devices which have to be installed in the computer (modem, fax/modem, scanner, printer). **1.3.3.** Installation of the drivers for peripherals to be connected to the computer according to the manufacturer's specifications. 1.3.4 if a peripheral device uses consumables the corresponding consumables are placed **1.3.5.** Test and verification for the proper operation of peripherals connected 1.3.6 adjusting any possible malfunction 1.3.7 correct identified fault and malfunctions 1.3.8 co-signs the relevant protocol

Table 2	*Units Subunits and Learning outcomes of Computer Software Technicians*	
Units	**Subunits**	**Learning outcomes**
	2.1 Manages computer	**2.1.1.** record computer software components in the central management system .

2.Manages and supports computer software and peripherals	**Software and computer applications**	**2.1.2** install possible updates to the operating system and software applications **2.1.3.** perfoms maintenance & optimization of the operating system once a month **2.1.4**communicate with the users and inform how to use the software applications **1.1. 5** Update the users manuals
	2.2 Manage peripheral devices and replaces consumables	2.2.1 monitors the condition of peripherals at regular intervals 2.2.2 records the stock of consumables 2.2.3 replace consumables where replaced 2.2.4 **4** record the sortages and orders the consumables required 2.2.5 informs users to optimize the use of peripherals and consumables

Table 2 ***Units Subunits and Learning outcomes of Computer Software Technicians***

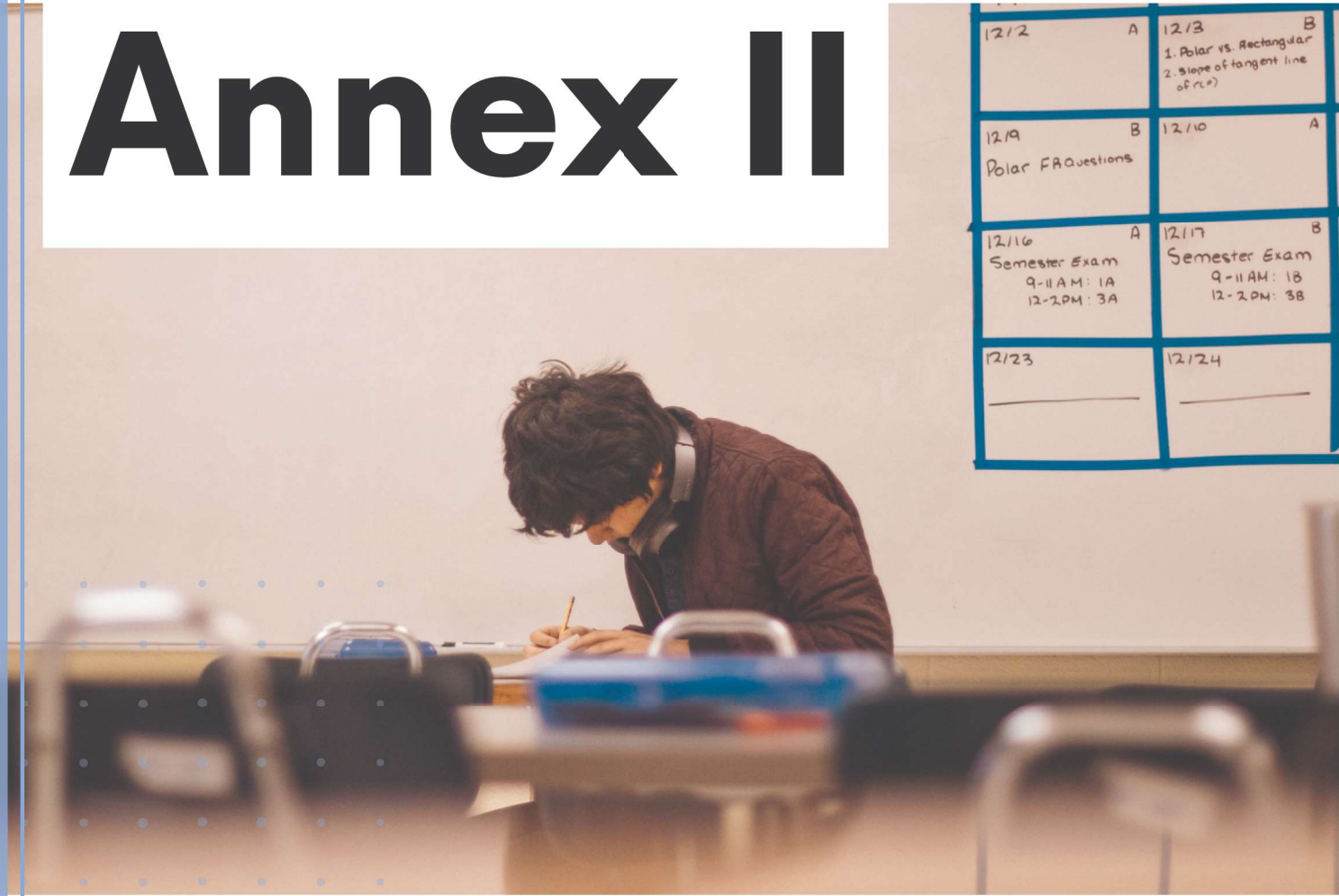
Units	Subunits	Learning outcomes
2. Detects and fixes malfunctions and failures	**3.1 detects and corrects malfunctions and failures of the software and software**	**3.1.1** receives by phone or internet reports of users for damage to the computer and applications **3.1.2** prioritizes user failures according to their importance **3.1.3** investigates the causes of

of the operating system and peripherals	**applications after being informed by the user**	operating system or software malfunctions **3.1.4** seeks and finds suitable solutions **3.1.5** communicates with the support department of the company that issues the operating system and software and finds in cooperation with them the appropriate solution **3.1.6** informs the central management system about the actions taken to resolve the faults **3.1.7** informs the user-customer
	3.2 detects and corrects malfunctions and failures of peripherals after notification by the user **And either corrects them or contact their replacement**	3.2.1 receives telephone or internet reports of users for peripheral device failures 3.2.2 prioritizes user failures according to their importance 3.2.3 investigates the causes of peripheral device malfunctions 3.2.4 examines whether it is a mechanical failure that cannot be corrected or whether it is a driver failure 3.2.5 fixes the problem and if not possible replaces the peripheral device with a new one 3.2.6 informs the central management system about the actions taken to resolve the faults 3.2.7 informs the user-customer

Units and Subunits validated according to L.O	Percentage according to L.O	ECVET Credits
1. Software Installation and placement of peripheral devices	100%	8
1.1 Installation and initialization of the operating system	40%	3,2
1.2: Installation of the Software (Open office, Works, Open source application)	40%	3.2
1.3: Installation of peripheral devices and their drivers	20%	1.6
2. **Manages and supports computer software and peripherals**	100%	8
2.1 Manages computer Software and computer applications	60%	4,8
2.2 Manage peripheral devices and replaces consumables	40%	3.2
3,Detects and fixes malfunctions and failures of the operating system and peripherals	100%	4
3.1 detects and corrects malfunctions and failures of the software and software applications after being informed by the user	50%	2
3.2 detects and corrects malfunctions and failures of peripherals after notification by the user And either corrects them or contact their replacement	50%	2
TOTAL		20

LEARNING AGREEMENT

Annex II



BEING A PART OF IT

Learning Agreement

1. **Information about the participants**	
Contact details of the home organisation	
Name of organisation	
Address	
Telephone/fax	
E-mail	
Website	
Contact person	
Telephone/fax	
E-mail	

Contact details of the host organisation	
Name of organisation	
Address	
Telephone/fax	
E-mail	
Website	
Contact person	
Tutor/mentor	
Telephone/fax	
E-mail	

Contact details of the learner	
Name	
Address	
Telephone/fax	
E-mail	
Date of birth	
Please tick	☐ Male ☐ Female
Contact details of parents or legal guardian of the learner, if applicable	
Name	
Address	
Telephone	
E-mail	

2. **Duration of the learning period abroad**	
Start date of the training abroad	
End date of the training abroad	
Length of time abroad	

3. **The qualification being taken by the learner - including information on the learner's progress (knowledge, skills and competence already acquired)**	
Title of the qualification being taken by the learner (please also provide the title in the language of the partnership, if appropriate)	**Metalworking Technician**
EQF level (if appropriate)	4
NQF level (if appropriate)	4

Information on the learner's progress in relation to the learning pathway (Information to indicate acquired knowledge, skills, competence could be included in an annex)	The learner 's progress related to the learning pathway is in primary level as they attend the 2nd class of the Vocational Lyceum. According to the Greek educational framework, this class is an introductory for specific knowledge, skills and abilities of the Software Technician. As a result, the learner has obtained general knowledge and basic competences and abilities which must be improved during the internship. Through the learning pathway the students should be able to associate their knowledge with competences and skills in respect to the learning outcomes. (For detailed information of the Metalworking Technician acquired knowledge, skills and competence refer to Annex Table 1)
Enclosures in annex - please tick as appropriate	☐ Europass Certificate Supplement ☐ Europass CV Ä Europass Mobility ☐Europass Language Passport ☐ European Skills Passport Ä (Unit[s] of) learning outcomes already acquired by the learner ☐ Other: (please specify here)

4. **Description of the learning outcomes to be achieved during mobility**	
Title of unit(s)/groups of learning outcomes/parts of units to be acquired	For Metalworking Technician units and subunits, refer to Annex (Table 2)
Number of ECVET points to be acquired while abroad	**The participant will get 20 ECVET points.**
Learning outcomes to be achieved	For Metalworking Technician learning outcomes, refer to Annex (Table 2)
Description of the learning activities (e.g. information on location(s) of learning, tasks to be completed and/or courses to be attended)	The participant will have a practical training period in companies relevant to his field of studies. He will be supervised by companies' tutors and he will implement duties that will offer an alternative way of learning.
Enclosures in annex - please tick as appropriate	Ä Description of unit(s)/groups of learning outcomes which are the focus of the mobility Ä Description of the learning activities ☐ Individual's development plan when abroad ☐Other: (please specify here)

5. **Assessment and documentation**	
Person(s) responsible for assessing the learner's performance	Name:
	Organisation, role:
Assessment of learning outcomes	Date of assessment: Close to the end of the practical training period.
	Method: The tutors should fill an assessment grid indicating the learners' progress of competences and abilities in respect to the learning outcomes.
How and when will the assessment be recorded?	The assessment grid listed in annex can work as an observation by which the company tutor can evaluate the autonomy of the trainee to operate each of the procedures of sub-units and to ensure an adequate standard of quality of expected results within the work process. The whole grid can be divided to partial assessments grids according to the completed subunits. The assessments can be done periodically, according to the work process schedule. Every assessment gives feedback on the learners' competences and abilities and work as an encouragement for them to improve their behaviour and work tasks in order to assure the achievement of learning outcomes. At about the halfway of the path, after an initial sharing of methodology and evaluation tools, using the assessment grid, an initial training evaluation can take place, to support the learning process of the participant. In the final stage takes place a specific allocation of tasks to test the autonomy of the participant in relation to the content of the subunits (summative assessment) The students are encouraged to keep logbooks (experiences, work organisation, language, intercultural environment, ect). This could be an additional basis for feedback and holistic evaluation of the internship

Please include	Ä Detailed information about the assessment procedure (assessment grid for every qualification) Ä Template for documenting the acquired learning outcomes (such as the learner's transcript of record or Europass Mobility) ☐ Individual's development plan when abroad ☐ Other: (please specify here)

6. **Validation and recognition**	
Person (s) responsible for validating the learning outcomes achieved abroad	Name:
	Organisation, role:
How will the validation process be carried out?	The Sending Organization will carry out the validation process on the basis of the assessment results by the Institution. Learners will get the supporting documents (transcript of records) from the host Institution. These documents should describe achieved learning outcomes.
Recording of validated achievements	Date:
	Method: The Sending Institution will issue a transcript of records with the validated learning units abroad.
Person(s) responsible for recognising the learning outcomes achieved abroad	Name:
	Organisation, role:
How will the recognition be conducted?	As the learning units are validated as a part of a final assessment the Sending Institution as a VET Provider will recognise the units achieved abroad by awarding a certificate of successful completion.

7. **Signatures**		
Home organisation/country	**Host organisation/country**	**Learner**
Name of the legal representative, role	**Name of the legal representative, role**	**Name**
Place and date	**Place and date**	**Place and date**

If applicable: Intermediary organisation	**If applicable: Parent or legal guardian**
Name, role	Name, role
Place, date	Place, date

8. Additional information

9. Annexes

***Table 1. Acquired knowledge, skills and competences for the qualification of* Metalworking Technician**

A. KNOWLEDGE

A1. GENERAL KNOLEDGE

1. Greek language: reading, comprehension, writing, speaking.

2. Mathematics: practical arithmetic, algebra, geometry.

3. Physics: engineering

4. Mechanical design: Reading, symbolism, use

5. Basic measurement systems: instruments, devices, conversions

6. Computer knowledge: operation, Data entry, data retrieval

A2. BASIC PROFESSIONAL KNOWLEDGE

1. Mechanical Technology: hand tools, machines and machine tools for processing and shaping materials.

2. Materials technology: metal structure, mechanical properties, alloys, applications.

3. Technical Engineering: tensile, compression, torsion, bending, moments, forces.

4. Mechanical Design: use of instruments and elements, design

5. Engine components: connection components

6. Health & safety at work: personal protective equipment, prevention of accidents at work, first aid. types of fire, firefighting

7. Basic use of Computer: operating systems, data retrieval from storage units or internet

8. Basic English: reading, comprehension, simple writing.

A3. SPECIFIC PROFESSIONAL KNOWLEDGE

1. Specifications of metal products: technical manuals, manufacturer specifications.

2. Special rolling mill equipment: devices, special tools.

3. Quality control: optical, dimensional. metrology.

4. Technical terminology of the specialty

5. English technical terminology

6. Organization and operation of a Workshop: methods, forms of organization and management of the workshop.

B. SKILLS

1. Use and writing of texts

2. Data analysis and use of conclusions

3. Focus on details

4. Task planning

5. Adaptability and flexibility

6. Problem solving- decision making

7. Methodology and inventiveness

8. Reaction speed

9. Precise handling of equipment

10. Application of devices for control of good operation of devices

C. ABILITIES

1. Speed and accuracy of perception

2. Numerical ability

3. Verbal ability

4. Observation

5. Technical ability

6. Spatial-perceptual ability

7. Ability to communicate

8. Initiative

9. Ability to plan and organize

10. Ability to undertake risks

Qualification: Metalworking Technician

Table 2: Units, Subunits and learning outcomes for Metalworking Technician.

Metalworking Technician		
Units	**Subunits**	**Learning outcomes**
UNIT 1 **Prepares and organizes the work.**	**1.1: Makes the appropriate measurements or uses the data of the drawings and sketches.**	**1.1.1**: Takes construction measures. **1.1.2:** Knowing typical mechanical materials. **1.1.3:** Makes similar calculations and draws geometric shapes based on measurements and other data.
	1.2. Selects the appropriate materials, tools and devices.	**1.2.1:** Selects the appropriate materials, depending on the type of construction and according to the construction specifications. **1.2.2:** Selects the appropriate hand tools (Mechanical and electrical). **1.2.3:** Prepares and adjusts workshop tools and equipment.
	1.3. Plans and organizes the work and materials.	**1.3.1**: Organizes the work according to the existing schedule. **1.3.2:** Calculates the required construction cost.

		1.3.3: Checks stocks and orders required materials
UNIT 2 **Manufactures products from metal pieces.**	**2.1: Takes the appropriate materials and captures in them the relevant measurements and the corresponding shapes.**	**2.1.1**: Get the right foil. **2.1.2**: Makes the appropriate calculations and uses the relevant drawing instruments. **2.1.3**: Captures on metal sheets the corresponding shapes based on the drawings and measurements.
	2.2: Cuts the metal sheets accordingly.	**2.2.1:** Selects the appropriate hand cutting tools or the appropriate machine and adjusts the cutting parameters. **2.2.2:** Place the sheet metal on the workbench or on the machine and cut it precisely. **2.2.3:** Uses personal protective equipment and follows safety measures at work. **2.2.4**: Controls the quality of work.
	2.3: Shapes the metal materials.	**2.3.1:** Selects the appropriate hardware formatting machine and adjusts the parameters. **2.3.2**: Format the material according to the drawings and technical instructions. **2.3.3:** Creates holes, flanges and various openings according to specific requirements.

	2.4: Assembles the construction	**2.4.1:** Uses plans and related instructions. **2.4.2:** Assembles the individual parts of the construction. **2.4.3**: Inspects the relevant parts or assemblies. **2.4.4**: Corrects according to specifications.
UNIT 3 **Installs the metal products and the required accessories**	**3.1: Installs manufactured metal products.**	**3.1.1:** Installs the retaining components. **3.1.2:** Installs and fastens the whole construction. **3.1.3:** Seals the construction in necessary
	3.2. Installs the required accessories and devices.	**3.2.1**: Install the retaining components. **3.2.2**: Installs accessories
	3.3. Carries out inspections, tests and adjustments, where required.	**3.3.1**: Carries out leak checks. **3.3.2**: Performs performance tests. **3.3.3**: Makes the relevant arrangements. **3.3.4:** Delivers the work and the corresponding documents to the client
UNIT 4	**4.1 General performance - occupational evolution**	**4.4.1:** Makes maintenance and repair procedures according to the manuals; with the correct use of the tools and other units of the workshop and by applying the safety rules
Organisation and safety - Social and communicative skills		**LO.4.4.2:** Cooperates in the best way with the other staff of the workshop

Table 3: Credits allocation to units and subunits.

Units and Subunits validated according to L.O.	Percentage according to L.O.	ECVET Credits
1. Prepares and organizes the work.	**100%**	**6**
1.1: Makes the appropriate measurements or uses the data of the drawings and sketches.	40%	2,4
1.2: Selects the appropriate materials, tools and devices.	30%	1,8
1.3: Plans and organizes the work and materials.	30%	1,8
2. Manufactures products from metal pieces.	**100%**	**6**
2.1: Takes the appropriate materials and captures in them the relevant measurements and the corresponding shapes.	25%	1,5
2.2: Cuts the metal sheets accordingly.	25%	1,5
2.3: Shapes the metal materials.	25%	1,5
2.4: Assembles the construction	25%	1,5
3. Detects and fixes malfunctions and failures of the operating system and peripherals	**100%**	**6**

3.1: Installs manufactured metal products.	40%	2,4
3.2: Installs the required accessories and devices.	30%	1,8
3.3: Carries out inspections, tests and adjustments, where required	30%	1,8
4. Organisation and safety - Social and communicative skills	**100%**	**2**
4.1: General performance - occupational evolution	100%	2
TOTAL		**20**

Assessment Grid in Erasmus+ placement (Erasmus PRO)							
Occupational profile: **Metalworking Technician**							
Student's Name (forename, family name)							
Use numbers and not tick symbols. Be sure you mark once per learning outcome!!!							
1. insufficient 2. sufficient 3. good 4. fairly good 5. very good 6. Excellent							
Unit 1	**Prepares and organizes the work.**	**1**	**2**	**3**	**4**	**5**	**6**
Subunit 1.1	**Makes the appropriate measurements or uses the data of the drawings and sketches.**						
Competences	Knows the safety rules and the protection equipment						
	Knows the outline and the flow process of machining.						
	Knows the technical characteristics of metal materials						
	Knows the use of tools for drilling and threading						

Assessment Grid in Erasmus+ placement (Erasmus PRO)								
	Knows the use of basic marking tools.							
	Knows the use of calipers and micrometers.							
Abilities	Selects and operates the measuring instruments correctly.							
	Records measurements accurately.							
	Uses the literature effectively.							
	Uses, reads and understands drawings and sketches.							
	Selects and uses drawing instruments correctly.							
	Uses handheld computers comfortably.							
	Captures geometric shapes according to measurements.							
		(Sum of marks / count of marks in subunit)						**0**

Assessment Grid in Erasmus+ placement (Erasmus PRO)							
Subunit 1.2	**Selects the appropriate materials, tools and devices.**						
Competences	Reads and understands the specifications of the materials						
	Selects appropriate materials.						
	Selects and handles hand tools skillfully.						
	Keeps tools in good condition.						
	Knows the operation of tools and machines.						
	Makes precise adjustments to tools and machines. Handles the workshop machinery properly.						
Abilities	He is able to use protection equipment in the right way.						
	He is able to function the machine						

Assessment Grid in Erasmus+ placement (Erasmus PRO)							
	He is able to make necessary adjustments						
	He is able to attend the processes for given applications						
	he is able to solve basic problems concerning the production process						
		(Sum of marks / count of marks in subunit)					**0**
Subunit 1.3	**Plans and organizes the work and materials.**						
Competences	Knows safety rules /protection elements						
	Realises the requirements of the work according to the available machines						
	Orders materials correctly and on time						
	Keeps the work schedule.						

Assessment Grid in Erasmus+ placement (Erasmus PRO)							
Abilities	Consider the specific requirements of the construction.						
	Calculates the cost of materials correctly.						
	Checks and records stocks in detail.						
	Fully knows the specifications of the materials.						
		(Sum of marks / count of marks in subunit)					**0**
Unit 2	**Manufactures products from metal pieces**	**1**	**2**	**3**	**4**	**5**	**6**
Subunit 2.1	**Takes the appropriate materials and captures in them the relevant measurements and the corresponding shapes.**						
Competences	Recognizes and selects the right materials.						
	Uses the necessary means of personal protection correctly.						

Assessment Grid in Erasmus+ placement (Erasmus PRO)								
	Uses the appropriate means of transporting the material effectively.							
	Fully understands measurements and sizes.							
Abilities	Uses computer units correctly.							
	Uses properly and effectively the design instruments.							
	Understands the plan.							
	Impresses the shapes on the metal.							
	Uses engraving tools correctly.							
		(Sum of marks / count of marks in subunit)					**0**	
Subunit 2.2	**Cuts the metal sheets accordingly**							
Competences	Checks correctly that the hand-cutting tools are in good condition.							

Assessment Grid in Erasmus+ placement (Erasmus PRO)							
	Fully confirms that the machine he selects is in safe operating condition.						
	Checks the machine and the area to be clean.						
	Checks correctly that the hand-cutting tools are in good condition.						
	Places the appropriate equipment on the machine correctly and carefully,						
	Adjusts the machine correctly according to the cut.						
	Cuts the specific piece.						
Abilities	Handle the cut piece carefully, avoiding bumps and abrasions.						
	Cleans and takes care of waste materials and waste with care for the environment.						
	Takes care of the right way all the measures						

Assessment Grid in Erasmus+ placement (Erasmus PRO)							
	Takes care of of personal protection						
	Takes care of safety measures at work.						
	Takes with great care and with the right way all the measures of personal protection						
		(Sum of marks / count of marks in subunit)					**0**
Subunit 2.3	**Appropriately shapes the metal materials**						
Competences	Takes care of all personal protection and safety measures at work.						
	Checks tools and appliances in good condition.						
	Confirms with certainty that the machine he chooses is in safe operating condition.						
	Checks the machine correctly and the space is clean.						

Assessment Grid in Erasmus+ placement (Erasmus PRO)							
	Installs the appropriate equipment in the machine, depending on the part to be shaped.						
	Adjusts the machine in detail according to the data.						
	Select the appropriate tools and devices.						
	Set the machine correctly and accurately.						
	Shapes the specific piece pricesly.						
Abilities	Handles the molded piece carefully, avoiding bumps and abrasions.						
	Follows the procedures described in the work plans for the production						
	Fully confirms that it has selected the appropriate tools and devices.						
	Precisely handles formatting tools.						

Assessment Grid in Erasmus+ placement (Erasmus PRO)							
		(Sum of marks / count of marks in subunit)					0
Subunit 2.4	**Assembles the construction**						
Competences	Analyzes and understands assembly processes.						
	Applies the rules of Safety at work						
	Follows the procedures described in the work plans, and all recorded instructions.						
	Uses the right tools and gadgets properly.						
	Carefully and correctly selects the appropriate rivets.						
	Controls and uses welding devices effectively to bet on holding points.						
	Implements corrections						

Assessment Grid in Erasmus+ placement (Erasmus PRO)							
Abilities	Makes a detailed visual inspection of the assembly product.						
	Uses instruments and measuring devices correctly.						
	Realises the use of procedures and instructions.						
	Reaslises and records deviations from the specifications and designs.						
	Decides quickly on how to implement corrective actions.						
	Methodically controls the final work						
		(Sum of marks / count of marks in subunit)					**0**
Unit 3	**Installs the metal products and the required accessories**	**1**	**2**	**3**	**4**	**5**	**6**
Subunit 3.1	**Installs manufactured metal products.**						

Assessment Grid in Erasmus+ placement (Erasmus PRO)								
Competences	Knows the safety rules and the protection equipment							
	Knows the outline and the flow process							
	Installs the retaining components.							
	Installs and fastens the whole construction.							
	Seals the construction in necessary							
Abilities	Uses equipment in the right way.							
	Uses materials correctly.							
	Fully understands written work instructions and applies them faithfully.							
		(Sum of marks / count of marks in subunit)						**0**
Subunit 3.2	**Installs the required accessories and devices.**							

Assessment Grid in Erasmus+ placement (Erasmus PRO)							
Competences	Knows the safety rules and the protection equipment						
	Install the retaining components.						
	Installs accessories						
Abilities	Uses equipment in the right way.						
	Uses materials correctly.						
	Fully understands written work instructions and applies them faithfully.						
		(Sum of marks / count of marks in subunit)					**0**
Subunit 3.3	**Carries out inspections, tests and adjustments, where required**						
Competences	Carries out leak checks.						
	Performs performance tests.						

Assessment Grid in Erasmus+ placement (Erasmus PRO)							
	Makes the relevant arrangements.						
	Delivers the work and the corresponding documents to the client						
Abilities	He is able to use protection equipment in the right way.						
	He is able to use the tools and devices properly						
	He is able to make bending procedures according to the plan or instructions given						
	He is able to make flaring and swaging procedures according to the plan or instructions given						
		(Sum of marks / count of marks in subunit)					**0**
Unit 4	**Organisation and safety - Social and communicative skills**	**1**	**2**	**3**	**4**	**5**	**6**
Subunit 3.3	**General performance - occupational evolution**						

Assessment Grid in Erasmus+ placement (Erasmus PRO)							
Competences	cooperates well with other colleagues						
	can realise and solve unexpected problems during rpair work						
	has a technical concept and intelligence in general						
	inductive and inferential way of thinking						
Abilities	ability to communicate at technical - professional level						
	technical concept on car issues and generally a mechanical concept						
	accuracy of perception on fault detection and troubleshooting						
	spatial-perceptual ability						
		(Sum of marks / count of marks in subunit)					**0**

TRANSCRIPT OF RECORDS

Annex III

BEING A PART OF IT

TRANSCRIPT OF RECORDS

ERASMUS+ PROGRAMME

ECVET - EUROPEAN CREDITS FOR VET

NAME OF SENDING ORGANIZATION **ECVET coordinator:** TEL ..... Fax: ..... e-mail: .....
SURNAME OF STUDENT:..... **First name:**..... Date and place of birth: ..... (Gender): ..... Tel.: e-mail:.....
NAME OF RECEIVING ORGANIZATION: ..... ECVET coordinator: ..... Tel.: ..... Fax: ..... e-mail:.....

Erasmus+ Projecct code:

Title of Qualification: «*Metalworking Technician*»

BEING A PART OF IT

Unit Subunit code (1)	Title of the Unit/Subunit	Duration of course unit	Grade (2)	Maximum ECVET credits (3)	ECVET credits (4)
1	**Prepares and organizes the work.**	**3 months**		**6**	
1.1	Makes the appropriate measurements or uses the data of the drawings and sketches.	3 months		2,4	
1.2	Selects the appropriate materials, tools and devices.	3 months		1,8	
1.3	Plans and organizes the work and materials.	3 months		1.8	
2	**Manufactures products from metal pieces.**	**3 months**		**6**	
2.1	Takes the appropriate materials and captures in them the relevant measurements and the corresponding shapes.	3 months		1,5	

2,2	Cuts the metal sheets accordingly.	3 months		1,5	
2,3	Shapes the metal materials.	3 months		1,5	
2,4	Assembles the construction	3 months		1,5	
3	**Installs the metal products and the required accessories**	**3 months**		**6**	
3,1	Installs manufactured metal products.	3 months		2,4	
3,2	Installs the required accessories and devices	3 months		1,8	
3,3	Carries out inspections, tests and adjustments, where required.	3 months		1,8	
4	**Organisation and safety - Social and communicative skills**	3 months		**2**	

4,1	General performance - occupational evolution	3 months		2	
				Total:20	Total:_ _

ECVET credits have been validated:

.....

Date: Signature of legal representative of the sending organization (Stamp)

NB : This document is not valid without the signature of the legal representative of the sending organization and the official stamp of the organization.

The Units and Subunits of the Qualification «***Metalworking Technician***» as it has been analysed. A qualification profile is attached to this document.

Description of the applied grading system:

The students have been assessed on the base of their performance in relation to all the expected learning outcomes. They receive grades on a 6-grade climax for all the learning outcomes.

1. Insufficient 2. Sufficient 3. Good 4. Fairly good 5. Very good 6. Excellent

In case the training activities don't cover some learning outcomes the students don't receive grades for them. In order to acquire the maximum ECVET credits per subunit they must cover at least 75% of the learning outcomes in 3 months period and to achieve average grade 4,5. In case the training activities cover less than 75% of the expected learning outcome the students receive a quote of the maximum ECVET credits. The quote is counted asfollows:

Covered Learning Outcomes in Subunit

_____ * Maximum ECVET credits for the Subunit

Total Learning Outcomes in Subunit

A list of achieved and non achieved learning outcomes is attached to this document.

*** Maximum ECVET credits: The maximum ECVET credits the students can acquire for the period of scheduled training activities.**

1 full academic year	=	60 credits
1 semester	=	30 credits
1 term/trimester (3 months)	**=**	**20 credits**

ECVET credits:

The ECVET credits will be validated to the participant. According to the mentioned above, they may be less than cited as maximum, due to reduced coverage of expected learning outcomes during the training period.

CERTIFICATE OF ATTENDANCE

Annex IV

BEING A PART OF IT

ANEXO IV. CERTIFICADO DE PARTICIPACIÓN

Co-funded by
the European Union

Certificate of Attendance

I, undersigned, (name of the legal representative (1)),

Director of the (Host Organization (2)), (Place of Host Organization(3))

hereby certify that the teacher (name of participant(5)), from the

(Sending Organization (4)),

has participated in the

Learning Teaching and Training Activities of the Erasmus+ Project (program title(8))

ID number (program code (unique Erasmus number)(7)),

that were held in (Place of Host Organization (3))

between the (mobility period (6)).

(Place, Date)

_____

(Legal representative name)

PLAN FOR ADAPTING THE DIDACTIC PROGRAM TO THE BPI METHODOLOGY

BY IES ENRIQUE TIERNO GALVÁN

Annex v

BEING A PART OF IT

Following the order set out in the previous point, we will begin by saying that, in order to adapt the didactic programming of the VET classroom-workshop linked to the company in the CFGM of Electrical and Automatic Installations, we use the mechanisms indicated in the previous section:

- We identified the training requirements of Somatica, Materials & Solutions, the company with which we were going to implement the BPI methodology.
- We incorporate the practical experience of the professors of the CFGM Department of Electrical and Automatic Installations.
- We hold virtual meetings with the company to foster collaboration and learn about the needs of the project.
- We have updated the didactic programme.
- We integrate the Techvetlab software for the management and coordination of the project with the company.

Faced with the question "how do we reflect them in the didactic programming of the training module that will be selected?", from the Department of Electricity-Electronics we propose a series of actions that we will detail below.

Indeed, when it comes to organising and planning the role that the VET teacher will play during the months in which the classroom-workshop of the CFGM where the training modules corresponding to the degree of Technician in Electrical and Automatic Installations are taught, it will be necessary for this space to be enabled to allow and facilitate the implementation of a project linked to a technology company, as well as the mechanisms for adapting the programming of the chosen training module during that school period.

It should also be noted that all this was achieved through a very innovative methodology, known as Being a part of it (BIS). An updated evolution of the Project-Based Learning (PBL) method, through which the classroom-workshop linked to studies (VET) Vocational Education and Training, It becomes a department of the company led by the teacher who will put it into practice. In fact, the main objective is to be an active and virtual part in the development of innovation projects of the participating companies, in this case, Somatica, Materials & Solutions LDA.

Somatica, Materials & Solutions LDA is a technology-based company dedicated to the research and development of smart and electroactive materials, offering products and creating effective solutions in line with the needs of its customers. Located in the Portuguese city of Braga, Somatica, LDA Materials & Solutions was founded in 2007 as Spin-off of the Physical Center of the University of Minho. Its emergence arose from the need to offer innovative solutions, applying the latest scientific and technological advances in the areas of Materials Engineering, Electronics, Physics, Automotive, Computer Science, Consumer and Health.

In view of the extraordinary opportunity that IKASIA has given us when it comes to the Department of Electricity-Electronics of the IES Enrique Tierno Galván collaborating closely with the technicians of the technology company Somatica, Materials & Solutions LDA for the realization of a Methodological Guide, we will begin by presenting a series of important points in this regard

The main objective of the aforementioned guide is that it includes all the necessary guidelines for the classroom-workshop of the CFGM of Electrical and Automatic Installations to become a virtual department of the technology company Somatica, Materials & Solutions LDA. With this, it will participate in technological research projects for two months starting in September 2023. In other words, its application in the classroom-workshop is scheduled for the beginning of the 2023/2024 academic year. Thus, this guide will offer a global adaptation of the planning of the classroom-workshop, the implementation of networking virtual with the company and the use of digital tools that equate this space with the company, allowing all students to develop critical parts within technological innovation projects.

In addition, the Methodological Guide will become a high-quality manual, which will allow the teacher responsible for implementing it in the CFGM to establish an annual study plan in coordination with the technicians of the aforementioned Portuguese company. As stated, everything will be carried out under the umbrella of BPI methodology. The aim is for students not only to learn to develop the skills and abilities required and requested by a leading company in the technological field, but also to participate in publications of recognized international prestige. A result that can be used by any European VET centre focused on the technology sector.

For all these reasons, and in view of the great challenge posed, the Department of Electricity-Electronics has programmed and organized a series of actions that we will now explain.

First of all, the head of the Department convened an extraordinary meeting to address the various points contained in the draft. The topics covered were as follows:

- Information from Professor Juan Bautista Tormos Capilla on what was discussed and agreed at the meeting of the Third Transnational Project Meeting TECHVETLAB 2021-1-ES01-KA220-VET-000029545, held in the Italian city of Florence on Wednesday, February 8, 2023
- Selection of the CFGM course in which the BPI methodology will be implemented
- In which training module this methodology will be included
- Who will be the teacher in charge of putting it into practice?
- Requests and Questions

Once all the members of the Department were aware of the factual background, they went on to select the course of the CFGM of Electrical and Automatic Installations that the professors considered most suitable for the implementation of the BPI methodology. The distinction of the selected training module was marked and conditioned by various reasons that we will now explain.

In the first place, the training modules taught in the second year of the CFGM were immediately discarded, since the fact that the FCT training module is contemplated in the last year conditions the time available to teachers to complete their training programs. For this reason, and because the first year has three more months of teaching time, it was decided to study the possibilities offered by the training modules taught in the first year.

Once the pros and cons of the training modules of the first year had been analysed, it was unanimously positively assessed that the implementation of the BPI methodology was carried out within the didactic programme of the training module of Indoor Electrical Installations. The reasons for this choice were several, but among them the versatility of this module and the fact that the tenured professor who currently teaches it is a permanent teaching staff at the IES Enrique Tierno Galván. This data is of the utmost importance, because this type of initiative in the field of extracurricular functions requires personal commitments from professors who have continuity in the Department. However, the responsibility for this initiative to come to fruition lies with all the members of the educational team of this CFGM, since experience indicates that it cannot become a personal action or project, but of an entire Department and with the institutional support of an VET educational center.

For all the above, and if we look at the timetable of the CFGM of Electrical and Automatic Installations (LOE), we can see that the aforementioned training module contemplates a weekly training of 8 teaching hours, with the total annual calculation being 256 hours. In other words, it is a training module that, in addition to its general scope within electrical engineering and its easy pedagogical adaptation, has enough hours to put into practice any methodological innovation such as the one we are discussing here.

FAMILIA PROFESIONAL: ELECTRICIDAD Y ELECTRÓNICA

CICLO FORMATIVO: INSTALACIONES ELÉCTRICAS Y AUTOMÁTICAS — GRADO: MEDIO — HORAS: 2000

1er CURSO										2º CURSO									
Módulo Formativo:	H.S.	H.A.	H.	H.	H.	H.	H.	H.	H.	Módulo Formativo:	H.S.	H.A.	H.	H.	H.	H.	H.	H.	H.
0232 Automatismos industriales (DT)	8	256		8						0236 Instalaciones de distribución	6	132							6
0233 Electrónica (1)	3	96	3							0237 Infraestructuras comunes de telecomunicación en viviendas y edificios (2)	5	110						5	
0234 Electrotecnia (1)	6	192	6							0238 Instalaciones domóticas (2) (DT)	6	132						6	
0235 Instalaciones eléctricas interiores (DT)	8	256		8						0239 Instalaciones solares fotovoltaicas (1) (DT)	3	66							3
0241 Formación y orientación laboral	3	96			3					0240 Máquinas eléctricas (DT)	5	110						5	
CV0001. Inglés Técnico I-M / Horario reservado para la docencia en inglés.	2	64								0242 Empresa e iniciativa emprendedora	3	66					3		
										CV0002. Inglés Técnico II-M / Horario reservado para la docencia en inglés.	2	44							
										0243 Formación en Centros de Trabajo		380							
Totales	30	960								Totales	30	1040							

CS/PS Formación y orientación laboral

PT Instalaciones electrotécnicas

CS/PS Sistemas electrotécnicos y automáticos

(1) Este módulo también podrá ser impartido, indistintamente, por un CS/PS Sistemas electrónicos.
(2) Este módulo también podrá ser impartido, indistintamente, por un PT Equipos electrónicos.
(DT) Módulo susceptible de desdoble total.

SCHEDULE FOR ELECTRICAL AND AUTOMATIC INSTALLATIONS

Likewise, and in relation to the versatility of the theoretical contents and practices contemplated in its annual didactic program, we consider that they can be coupled to any curriculum of an innovation technology company. We can argue this by reflecting the contents that are contemplated in its curriculum, as articulated in the ORDER of July 29, 2009, of the Ministry of Education, DOGV number 6093 of February 2, 2009:

Training module: Indoor Electrical Installations
Code: 0235
Duration: 256 hours
Contents:

Basic Indoor Electrical Circuits:

- Elements and mechanisms in housing facilities.
- Types of receivers.
- Installation (light points and accessories).
- Types of mechanisms.
- Assembling mechanisms.
- Common installations in homes and buildings.
- Power tool.
- Analysis and measurement equipment (protection tester, network analyzer, etc.).
- Electrical conductors.
- Fundamental measures in housing.
- Conventions of representation. Standard Symbology in electrical installations.
- Standard electrical drawings and diagrams. Typology.
- Interpretation of electrical diagrams of the installations of housing, public premises and industrial premises.
- Software for the representation of electrical circuits and installations.
- Technical and commercial catalogues of manufacturers.
- Budgeting.

Electrical installations in homes:

- Types of electrification according to REBT for electrical installations indoor.
- General conditions for indoor installations according to REBT.
- Supports and fixings of elements of an installation.
- Connection of mechanisms.
- Cutting and protection devices.
- Direct and indirect contacts.
- Protection against overvoltages and overcurrents.
- Automatic devices (regulators, remote switches, automatics) of stairs, twilight, schedules, etc.).
- Conductor connection elements.
- –Surrounding.
- Earthing of homes and buildings.
- Electrical measures related to housing installations.
- Specific pipes for homes.
- Preparation and assembly of pipes (corrugated pipe, pipe
- Rigid PVC, metal pipe, gutter, among others). Auxiliary Accessories (distribution boxes, stands, etc.).
- Electrification levels and number of circuits.
- Splicing and wiring procedures.
- Premises containing a bathtub.
- Degrees of protection of the enclosures.
- Lighting device for domestic use.
- Specific regulations of the REBT in interior lighting.

Documentation of the installations:

- Specific regulations of the REBT.
- Technical design report, installation certificate, instructions
- general use and maintenance, among others.
- Standards associated with standardised quality criteria.
- Reporting.
- Electrical projects.
- Recognition of its parts.

Facilities of public places:

- Special characteristics of public places.
- Types of electrical supplies.
- Power forecasting.
- Emergency circuit and lighting.
- Facilities in meeting and work rooms.
- General and secondary protection panels in premises of public attendance.
- Automatic devices (regulators, teleswitches, twilight, schedules, etc.).
- Special electrical conduits.
- Lighting devices. Types of lamps and their use.
- Specific regulations of the REBT with respect to public premises concurrence.
- Installations in specific venues (shows, educational centres) and others).
- Lighting circuits, equipment and luminaires (assembly, connection, choice).

Installations of commercial and/or industrial premises:

- Specific regulations of the REBT.
- Basic notions of the relevant calculations in the installations for industrial and/or commercial use.
- Site classes I and II.
- Class I electrical equipment.
- Class II electrical equipment.
- Cabling systems.
- Automatic devices (regulators, teleswitches, twilight, hours, etc.).
- Installation in wet rooms.
- Installation in premises with a risk of corrosion.
- Installation in dusty premises without risk of fire.
- Installation of premises at high temperatures.
- Installation of premises with batteries or accumulators.
- Installation in premises with special characteristics.
- Lighting circuits, equipment and luminaires (assembly, connection, choice).

Maintenance and detection of faults in electrical installations:

- Electrical safety regulations.
- Typical breakdowns in installations for domestic or industrial use. Symptoms and effects.
- Fault diagnosis (tests, measurements, procedures and elements security).
- Repair of breakdowns.
- Maintenance of electrical installations for domestic use.
- Maintenance of electrical installations in public premises concurrency or industrial premises.

Commissioning of housing installations, public premises Concurrency or Industrial:

- Specific regulations of the REBT.
- Documentation of the installations. The project and the memory design technique.
- Execution and processing of the installations.
- Commissioning of the facilities.
- Measuring devices commonly used in electrical installations.
- Tension, intensity and continuity measurements.
- Measurements of electrical power and power factor.
- Network analyzer.
- Isolation measures.
- Ground and soil resistance measures.
- Sensitivity measurements of cutting and protective equipment.

Occupational risk prevention and environmental protection:

- Identification of risks.
- Determination of occupational risk prevention measures.
- Prevention of occupational hazards in assembly processes and maintenance.
- Personal protective equipment.
- Compliance with occupational risk prevention regulations.
- Compliance with environmental protection regulations.

In this sense, it is also interesting to reflect the general contents of this training module contained in one of the files framed in the Europass documents, specifically, the so-called Supplement to the Europass Title in its English version (Source: https://todofp.es/dam/jcr:256d7106-889c-497d-a913-f6f445fa1ed6/n-tinstalacioneselectricasautomaticasen-pdf.pdf).
“Interior Electrical Installations”
The holder:

- Installs basic electrical circuits interpreting technical documentation.
- Installs the electrical installation of a house with a basic degree of electrification applying the Spanish electro technical low voltage regulation (REBT).
- Drafts the technical report on the electrical installation of a house with a high degree of electrification in accordance with the REBT.
- Installs the electrical installation of a public building, applying specific regulations and justifying each element within the group.
- Installs the electrical installation of industrial facilities in accordance with the REBT.
- Maintains interior electrical installation applying electrical measurement techniques and relating malfunctions with the causes that produce them.
- Verifies the commissioning of the electrical installation in a public building or industrial facility in accordance with the specifications of personnel authorised by the REBT.

Once the contents to be taught in the selected training module have been planned, we go on to detail the competencies and learning outcomes that must be achieved by the students from the development of the teaching action.

As we have mentioned, the main objective of vocational training is to provide students with a series of skills, knowledge and skills so that they can function with ease in the world of work, this will be understood as competence. In order to develop these skills, they are divided into different professional qualifications that are structured in the different training modules.

In addition, it is important to know that, obviously, in order to obtain the degree and the certificate of professionalism, the units of competence will be taken as a reference, which will be the minimum conditions for obtaining them. For the module in question, Indoor Electrical Installations, the professional, personal and social competencies are provided by RD 1147/2011 and we indicate below those included in it:

- Establish the logistics associated with assembly and maintenance, interpreting the technical documentation of the facilities and equipment.
- Configure and calculate installations and equipment, determining the location and dimensions of the elements that constitute them, respecting the regulatory requirements.
- Prepare the budget for the assembly or maintenance of the installation or equipment.
- Gather the resources and means to undertake the execution of the assembly or maintenance.
- Redesign the installation in accordance with the technical documentation, solving the problems of its competence and informing of other contingencies to ensure the viability of the assembly.
- Assemble the equipment and conduits associated with electrical installations [...] in conditions of quality, safety and respect for the environment.
- Maintain and repair facilities and equipment, carrying out checking, adjusting and replacing their elements, restoring their operation in conditions of quality, safety and respect for the environment.
- Verify the operation of the installation or equipment by means of functional and safety tests in order to proceed with its commissioning or service.
- Prepare the technical and administrative documentation in accordance with the regulations and regulations in force and the requirements of the client.
- Solve problems and make individual decisions following established rules and procedures, defined within the scope of their competence.

Secondly, we find the learning outcomes, which can be defined as the goals that the student must achieve in this training module in question. In the field of VET, they are called objectives, and all of them are defined in current legislation. When students achieve all the learning outcomes, they will also have achieved all the objectives of the module, the vocational training, as well as those related to the vocational training itself.

On the other hand, and associated with the learning outcomes, we find the evaluation criteria that will help us to know if the student has achieved these results. Below, we show in the following table the learning outcomes and their associated evaluation criteria for the training module of Indoor Electrical Installations:

LEARNING OUTCOMES – ASSESSMENT CRITERIA

RA 1 - Assemble basic electrical circuits by interpreting technical documentation.

1.1 The electrical diagrams have been interpreted by analysing their operation.
1.2 The appropriate tools have been used for each installation.
1.3 The operation of the facilities has been verified.
1.4 The principles of operation of mechanisms and receptors have been described.
1.5 The electrical magnitudes of the installation have been calculated.
1.6 Key magnitudes have been measured.
1.7 The various receivers have been properly assembled.
1.8 Connections have been made in accordance with the standard.

RA 2- Assemble the electrical installation of a house with a basic degree of electrification applying the low voltage electrotechnical regulation (REBT).

2.1 The installation assembly plan has been drawn up.
2.2 Provision has been made for the necessary mechanisms and elements.
2.3 Each of the elements within the installation as a whole and in commercial catalogues has been identified.
2.4 The operation of the installation (protections, earthing, among others) has been verified.
2.5 The appropriate tools have been used for each of the elements.
2.6 The REBT has been implemented.

RA 3 - Carries out the technical design report of a housing installation with a high degree of electrification in accordance with the REBT.

3.1 The characteristics of the installation have been identified according to its use and power.

3.2 A short explanatory memorandum has been drawn up.

3.3 One-line circuit diagrams have been drawn with standardization in mind.

3.4 The cutting and protection devices of the dwelling have been calculated.

3.5 A sketch of the house and the facility has been drawn.

3.6 Catalogues and technical documentation have been used to justify the decisions taken.

RA 4 - Assemble the electrical installation of a public premises, applying the regulations and justifying each element as a whole.

4.1 The correct operation of the emergency lighting has been verified.

4.2 The secondary power supply appropriate to the type of premises has been installed.

4.3 All circuits have been checked for proper operation.

4.4 The safety and quality measures of this type of installation have been taken into account.

4.5 The general protection table has been drawn up according to the type of installation and the REBT.

4.6 The necessary secondary switchboards have been installed.

RA 5 - Assembles the electrical installation of a premises intended for industrial use, in accordance with the REBT.

5.1 The appropriate lighting has been installed depending on the uses of the different rooms of the installation.

5.2 The necessary calculation has been made for the installation of luminaires.

5.3 The correct operation of the entire installation has been verified.

5.4 The most appropriate type of conduit has been used for each part of the installation, taking into account its environment and use.

5.5 The necessary calculations (powers, sections, etc.) have been carried out.

5.6 The appropriate tool has been used at all times.

5.7 The expected times have been taken into account in accordance with an agreed quality procedure.

RA 6 - Maintains indoor installations by applying electrical measurement techniques and relating the dysfunction to the cause that produces it.

6.1 Symptoms of breakdowns have been verified through the measurements carried out and the observation of the installation.

6.2 Reasoned hypotheses have been proposed as to the possible causes and their impact on the facility.

6.3 The fault has been located using a technical intervention procedure.

6.4 It has operated autonomously in the resolution of the fault.

6.5 Maintenance measures have been proposed to be carried out on each circuit or element of the installation.

RA 7 - Verifies the commissioning of an installation of a public premises or industrial premises in accordance with the specifications of the installer authorised in the REBT.

7.1 The adequacy of the installation to the instructions of the REBT installation has been verified.

7.2 The resistance of the earthing and the leakage current of the installation have been measured.

7.3 The values of the characteristic parameters have been measured and recorded.

7.4 The tripping sensitivity of residual current circuit breakers has been verified.

7.5 Circuit continuity has been measured.

RA – 8 Complies with occupational risk prevention and environmental protection standards, identifying the associated risks, the measures and equipment to prevent them.

8.1 The risks and level of hazard posed by the handling of materials, tools, tools, machines and means of transport have been identified.

8.2 The machines have been operated in compliance with safety regulations.

8.3 The most frequent causes of accidents in the handling of materials, tools, cutting and forming machines, among others, have been identified.

8.4 The safety features of the machines and the personal protective equipment to be used in the various assembly and maintenance operations have been described.

8.5 The handling of materials, tools and machines has been linked to the required safety and personal protection measures.

8.6 Potential sources of contamination of the environment have been identified.

To sum up, an effort must be made to define and specify the requirements and needs of companies, and in order for these to be worked on and developed over the course of the course, they must be integrated into the didactic program through the definition and subsequent development of both the competencies and the different learning outcomes.

In short, and for all the above, the Department of Electricity-Electronics of the IES Enrique Tierno Galván de Montcada (Valencia), considers that in order to carry out jointly with the company Somatica, Materials & Solutions LDA the implementation of the BPI methodology in our classroom-workshop, the ideal training module is that of Indoor Electrical Installations. A training action within the Erasmus + lifelong learning projects that, in this specific case, will allow the VET teacher involved to be an active and virtual part in the development of the innovation projects carried out by this technology company.

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